START

WHC-EP-0300

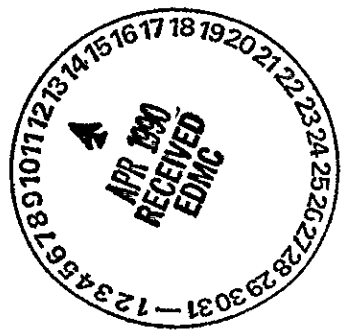
008430

72

Alternatives to Land Disposal of Solid Radioactive Mixed Wastes on the Hanford Site

P. H. Jacobsen
D. R. Duncan

Date Published
March 1990

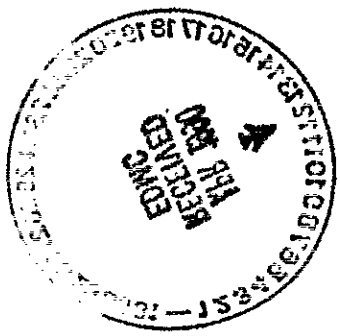


Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Restoration
and Waste Management Programs

Westinghouse Hanford Company
P.O. Box 1970
Richland, Washington 99352

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

This page intentionally left blank.



EXECUTIVE SUMMARY

This report was prepared in response to *Hanford Federal Facility Agreement and Consent Order* (termed the Tri-Party Agreement [TPA] [DOE et al. 1989]) milestone M-25-00. That milestone statement is:

"Provide annual reports of studies/efforts that are in progress to identify alternatives to land disposal of radioactive mixed wastes (RMW).

The annual reports will provide information regarding actions taken to minimize waste generation, recycle/reclaim wastes, or treat wastes."

The scope of the report is "solid" waste. For the purposes of this report, and consistent with the terminology at the Hanford Site, "solid" waste refers to wastes which are containerized typically in drums or boxes before storage, treatment, or disposal. Wastes in double-shell (DST) or single-shell tanks (SST) (including high-level waste (HLW) and the low-level waste (LLW) fraction destined for the Grout Treatment Facility [GTF]), and the 33 liquid effluent streams currently discharged to soil column disposal units, are not within the solid waste scope of this report. Treatability of tank wastes is the subject of TPA milestone M-04-00 and treatment of the liquid effluent streams are the subject of TPA milestone M-17-00.

This is the first of such annual reports. It will summarize Hanford Site efforts to employ alternatives to land disposal of RMW, which contain both radioactive and hazardous constituents, by reviewing waste minimization

and treatment plans, activities, and other related waste management activities presently and in future work. This report will be current as of the first quarter of fiscal year (FY) 1990.

Alternatives to land disposal will be considered in the following steps, consistent with the Washington Administrative Code (WAC) and Federal regulations:

1. Reduce waste generation (minimization)

2. Recycle usable constituents

3. Treat wastes through physical, chemical, or biological methods

4. Incinerate combustible wastes (e.g., hexone)

5. Stabilize and solidify wastes.

Specific examples of ongoing alternatives at Hanford are:

- Minimization of wastestreams at the source

- Distillation and incineration of radioactively contaminated hexone using a mobile incineration unit with low-level residues disposed of onsite and transuranic (TRU) RMW residues shipped to the Waste Isolation Pilot Plant (WIPP)

- Storage of RMW in the Hanford Central Waste Complex (HCWC) pending the selection of approved treatment/disposal methods.

Other onsite treatment methods are being studied and will be selected for other candidate RMW streams.

To encourage a policy to find alternatives to disposal, the Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) have developed separate programs restricting the land disposal of hazardous wastes and hazardous waste constituents unless certain standards are met. Disposal of certain restricted wastes, as identified by Title 40 of the Code of Federal Regulations (CFR) Part 268 and by the *Washington State Dangerous Waste Regulations*, WAC 173-303, is considered unlawful unless performed in accordance with regulations promulgated by the EPA and Ecology. These land disposal restricted (LDR) wastes cannot be land disposed before treatment to the listed treatment standards or to the specified technologies as published in Title 40 CFR 268 and WAC 173-303-140. Waste meeting these standards does not require treatment. The solid wastestreams identified on the 560 mi^2 Hanford Site as LDR-RMW are given in this report as well as the planned disposition of current and future LDR-RMW streams.

Treatment standards have not been promulgated specifically for RMW. The treatment standards (Appendix A in this report) for the hazardous waste

constituents must be used in determining acceptable levels and techniques per U.S. Department of Energy (DOE) Order 5400.3, "Hazardous and Radioactive Mixed Waste Program."

A summary of completed or planned alternatives activities is given below.

Summary of Completed or Planned Alternatives to RMW Land Disposal

The following activities have been completed to date:

- A draft waste minimization and pollution prevention awareness guidelines was prepared and reviewed.

- Facility-specific waste minimization guidelines are being prepared. Approximately 60 percent of the facility-specific plans have been completed.

- A draft engineering study including treatment options in Module II of the Waste Receiving and Processing Facility (WRAP) was completed.

- Input to the national report on LDR-RMW completed.

- A biennial waste minimization study was issued in FY 1988.

- Waste segregation to aid in minimization of RMW was aided by the formation of a Segregation Review Committee (whose function is now performed by the LLW Certification Committee).

- Process improvements in operating facilities resulted in the minimization of RMW in two Hanford wastestreams.

- A study to treat hexone RMW by distillation and incineration was issued.

- Six low flashpoint storage modules were put into place in the HCWC.

- Two RMW storage buildings were in operation at the end of FY 1989:

- Eleven 4,000 ft^2 RMW storage buildings were under construction for a total of 13 buildings planned for operation in 1990.

- Design was started on Project W-016, a 34,000 ft^2 RMW storage building.

The following activities will be completed in FY 1990 in support of alternatives to RMW land disposal:

- A waste minimization and pollution prevention awareness guidelines for the Hanford Site will be issued. This plan was completed in draft form and reviewed in the first quarter of FY 1990.

- The biennial waste minimization study will be issued.

- All Hanford Site waste generators will prepare waste minimization plans describing each contractor's specific program. These plans are to be completed by May 9, 1990.

- The hexone RMW will be distilled as the first step in its distillation/incineration treatment process.

- A study on separation of radioactive constituents from polychlorinated biphenyl (PCB)-contaminated waste will be issued.

- A review of the advanced conceptual design study for WRAP Module I will be completed

- A 30 percent design review of the conceptual design for WRAP Module II will be completed.

- Eleven RMW storage buildings are planned for operation the second quarter of FY 1990.

- Certification plans for disposal of LLW will be prepared by all generators shipping waste to the Hanford Site. The plans will include waste minimization efforts, volume reduction, and waste characterization for radionuclides and hazardous constituents.

- Construction will be completed on Phase I of Project W-016

- Acceptance criteria for RMW will be included in WHC-EP-0063-1, "Hanford Site Radioactive Solid Waste Acceptance Criteria," (Stickney 1989) for disposal of waste in the W-025 Trench.

This page intentionally left blank.

CONTENTS

CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ASW	ammonia scrubber waste
BDAT	best demonstrated available technology
CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH	contact-handled
D&AL	Development and Analytical Laboratories
DOE	U.S. Department of Energy
DP	defense programs
DST	double-shell tank
DWTM	Office of Defense Waste and Transportation
Ecology	Washington State Department of Ecology
EHW	Extremely Hazardous Waste (State)
EP	extraction procedure (toxic)
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facilities Compliance Agreement and Compliance Order on Consent
FFTF	Fast Flux Test Facility
FMEF	Fuels and Materials Examination Facility
FY	Fiscal Year
GTF	Grout Treatment Facility
HCWC	Hanford Central Waste Complex
HEHF	Hanford Environmental Health Foundation
HLW	High-level waste
HOC	halogenated organic carbon
HSWA	Hazardous and Solid Waste Amendments of 1984
HWVP	Hanford Waste Vitrification Project
ICP	inductively coupled plasma
INEL	Idaho National Engineering Laboratory
LANL	Los Alamos National laboratory
LDR	Land Disposal Restricted (commonly referred to as land ban)
LL	low-level
LLW	low-level waste
MASF	Maintenance and Storage Facility
MOA	Memorandum of Agreement
MOTA	Material Open Test Assembly
MW	mixed waste (also see RMW)
MWTF	Mixed Waste Treatment facility
NDA	nondestructive analysis
NFPA	National Fire Protection Association
NPH	normal paraffin hydrocarbon
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratories
PRF	Plutonium Reclamation Facility
PUREX	plutonium-uranium extraction (plant)
R-SWIMS	Richland-Solid Waste Information Management System
RCRA	Resource Conservation and Recovery Act
RL	Richland Operations Office

ACRONYMS AND ABBREVIATIONS (continued)

RH	remote-handled
RMW	Radioactive Mixed Waste or Mixed Waste (MW)
RPSF	Radioisotope Power System Facility
RSU	retrievable storage unit
SIP	Space Isotope Program
SPOA	Segregation Plan of Action
SRF	Size Reduction Facility
SST	single-shell tank
SWSR	Solid Waste Storage Record
TCP	tri-butyl phsophate
TPA	Tri Party Agreement (Hanford Federal Facility Agreement and Consent Order by the Ecology, DOE, and EPA)
TPB	tri-butyl phosphate
TRU	transuranic
TRUPACT	transuranic package transportation
TSCA	Toxic Substances Control Act
TSD	treatment, storage, and disposal (facility)
UO_3	"uranium oxide"
WAC	Washington Administrative Code
WAC	Washington (State) Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing (Facility)
WRSC	Waste Reduction Steering Committee

This page intentionally left blank.

1.0 INTRODUCTION

This report was prepared in response to the *Hanford Federal Facility Agreement and Consent Order* (termed the Tri-Party Agreement [TPA] [DOE et al. 1989b]) or milestone M-25-00, "Alternatives to Mixed Waste Land Disposal." This report will be updated annually to reflect the following:

- Status and impact of regulations governing disposal of land disposal restricted (LDR) radioactive mixed waste (RMW)
- New efforts to identify alternatives to RMW land disposal
- Status of ongoing efforts related to RMW land disposal alternatives
- Information on the actions being taken to minimize, or otherwise reduce, the generation of RMW
- Efforts to recycle or reclaim RMW streams
- Treatment of existing or new RMW streams.

Solid wastestreams classified as RMW (both radioactive and hazardous per Department of Energy-Richland Office (DOE-RL) Order 5400.3 (DOE 1988a), "Hazardous and Radioactive Mixed Waste Program" and as defined in Title 40 Code of Federal Regulations (CFR) 261 and Washington Administrative Code (WAC) Chapter 173-303-140 will be reviewed in this annual report.

The scope of this report is "solid" waste, which for the purposes of this report, and consistent with the terminology at the Hanford Site, refers to wastes which are containerized before storage, treatment or disposal, typically in drums or boxes. Wastes in double-shell (DST) or single-shell tanks (SST) (including high-level waste [HLW] and the low-level waste [LLW] fraction destined for the Grout Treatment Facility [GTF]), and the 33 liquid effluent streams currently discharged to soil column disposal units, are not within the solid waste scope of this report. Treatability of double-shell and single-shell tank wastes is the subject of TPA milestone M-04-00 and treatment of the liquid effluent streams are the subject of TPA milestone M-17-00.

1.1 Public Law

The Hazardous and Solid Waste Amendments (HSWA) of the Resource Conservation and Recovery Act (RCRA) were enacted on November 8, 1984. As a part of HSWA, Congress directed the U.S. Environmental Protection Agency (EPA) to set up provisions that would severely restrict all forms of hazardous waste from land disposal and require treatment to prescribed standards. These restrictions have shifted planned waste management alternatives from land disposal to waste minimization and reduction of existing volumes, the recycling of usable constituents, and the use of effective treatment techniques. Radioactive mixed wastes were not recognized

as part of these provisions until the byproduct rule was published by DOE-Headquarters in Title 10 CFR Part 962 dated May 1, 1987. As a consequence, it is not certain planned RMW alternatives to disposal will meet already established treatment standards.

The Washington State Department of Ecology (Ecology) has a separate program for restricting the land disposal of specified hazardous wastes, or "dangerous wastes" as defined in WAC 173-303-140. This program, which became effective February 5, 1988 for hazardous wastes and November 23, 1987 for RMW, restricts from land disposal a different set of wastes than that of the Federal program (see the Appendix). However, the intent is similar to that of EPA: to encourage minimization and reduction, recycling, and treatment of hazardous waste and to discourage disposal of waste on the land.

1.2 HANFORD SITE IMPACTS

Both the Federal and State land disposal restriction programs are applicable to the Hanford Site and impact waste management operations. Restricted wastes that are not mixed with radionuclides are managed through a sitewide program that temporarily stores wastes before transportation to offsite treatment, storage, and disposal (TSD) facilities. However, DOE Order 5820.2A (DOE 1988b) regards the hazardous component of any waste to be controlled by RCRA, as such, compliance issues at the Hanford Site are primarily associated with RMW management, particularly the lack of available treatment methods.

1.2.1 Present Treatment

No treatment techniques approved as best demonstrated available technology (BDAT) are in use at the Hanford Site. Also, treatment standards have yet to be published on some forms of identified LDR-RMW.

1.2.2 Future Treatment Capability

There are planned treatment options for the future such as the Waste Receiving and Processing (WRAP) Facility, hexone incineration, and treatment of radioactively contaminated polychlorinated biphenyls (PCB). However, many wastes are yet to be evaluated for required treatment; therefore, comprehensive planning for treatment technologies has not been made. Studies are planned to evaluate the suitability of proposed treatment of existing and newly generated wastes.

2.0 SCOPE

The scope of this report will include descriptions of all identified solid RMW streams and the planned disposition. A brief discussion is included of applicable laws and regulations, both state and federal, relating to LDR waste treatment and disposal options. Plans, reports, and schedules relating to the disposition of specific categories or streams that have been identified at the Hanford Site are also discussed. New or planned technologies will be discussed briefly, as will current studies on proposed storage, treatment, and disposal alternatives.

A section is included (section 3.0) that summarizes the following activities related to the storage, treatment, and disposal of LDR-RMW:

- Activities that were completed or in progress in Fiscal Year (FY) 1989
- Activities that are forecast for start up or completion in FY 1990.

This page intentionally left blank.

3.0 SUMMARY OF ACTIVITIES RELATED TO LAND DISPOSAL RESTRICTED-RADIOACTIVE MIXED WASTE

3.1 ACTIVITIES COMPLETED OR IN PROGRESS AT THE END OF FISCAL YEAR 1989

The following activities related to the storage, disposal, and treatment of LDR-RMW at the Hanford Site were completed or in progress in FY 1989.

- A draft waste minimization and pollution prevention awareness guidelines was prepared and reviewed.
- Each Hanford Site contractor is preparing a waste minimization plan describing the contractor's specific program.
- A draft engineering study including treatment options (stabilization, incineration, neutralization) in Module II of WRAP was completed.
- Input to the national report on LDR-RMW completed.
- A biennial waste minimization study was issued in FY 1988.
- Waste segregation to aid in minimization of RMW was aided by the formation of a Segregation Review Committee (whose function is now performed by the LLW Certification Committee).
- Process improvements in operating facilities resulted in the minimization of RMW in two Hanford wastestreams.
- A study to treat hexone RMW by incineration was issued.
- Six low flashpoint storage modules were put into place in the HCWC.
- The following RMW storage buildings were in operation at the end of FY 1989:
  - 2401-W
  - 2402-W
- Eleven 4,000 ft^2 RMW storage buildings were under construction for a total of 13 buildings planned for operation in 1990.
- Design was started on Project W-016, Phase I, a 34,000 ft^2 RMW storage building.

3.2 ACTIVITIES PLANNED FOR FISCAL YEAR 1990

The following activities are expected to be active or complete in FY 1990 related to the storage, disposal, and treatment of LDR-RMW at the Hanford Site.

- A waste minimization and pollution prevention awareness guidelines for the Hanford Site will be issued. This plan was completed in draft form and reviewed in the first quarter of FY 1990.
- All Hanford Site waste generators will prepare waste minimization plans describing each contractor's specific program. These plans are to be completed by May 9, 1990.
- A study on separation of radioactive constituents from PCB-contaminated waste will be issued.
- A review of the advanced conceptual design study for WRAP Module I will be completed.
- A 30 percent design review of the conceptual design for WRAP Module II will be completed.
- The following additional RMW storage buildings are planned for operation the second quarter of FY 1990:

-2402-WB	-2402-WE	-2402-WH	-2402-WK
-2402-WD	-2402-WF	-2402-WI	-2402-WL
-2402-WC	-2402-WG	-2402-WJ	

These facilities will supplement 2401-W and 2402-W.

- Certification plans for disposal of LLW will be prepared by all generators shipping waste to the Hanford Site. The plans will include waste minimization efforts, volume reduction, and waste characterization for radionuclides and hazardous constituents.
- Construction will be completed on Phase I of Project W-016.
- Acceptance criteria for RMW will be included in future revisions of WHC-EP-0063-1, "Hanford Site Radioactive Solid Waste Acceptance Criteria," (Stickney 1989) for disposal of waste in the W-025 Trench.

4.0 DEFINITIONS

4.1 LAND DISPOSAL RESTRICTED WASTES

A brief summary of land disposal restriction regulations and lists is given in this section. Tables of applicable wastes and treatment standards are shown in the Appendix.

4.1.1 Federal Restrictions

Federal land disposal restrictions encompass a very complex and expansive set of regulations. The purpose of this section is to briefly describe some of the more important aspects of these regulations to the Hanford Site. A more complete description of these regulations is available in the various preambles accompanying proposed and final rules and notices associated with the Federal land disposal restrictions program. Preamble information of particular importance is contained in the following references:

Solvents and dioxins	51 *Federal Register*, 40572 - 40654, November 7, 1986, Final Rule
California List wastes	52 *Federal Register*, 25760 - 25792, July 8, 1987, Final Rule
California List metals	52 *Federal Register*, 29992 - 30040, and cyanides August 12, 1987, Notice of Availability and Request for Comments
First Third wastes	53 *Federal Register*, 31138 - 31222, August 17, 1988, Final Rule
Second Third wastes	54 *Federal Register*, 26594 - 26652, June 23, 1989, Final Rule
Third Third wastes	54 *Federal Register*, 48372 - 48529, November 22, 1989, Proposed Rule.

The dates for applicability of the restrictions, which differ dependent on the specific list, are given in Table 1 in the Appendix.

Federal land disposal restriction regulatory requirements are contained in Title 40 CFR Part 268. Because the Federal land disposal restriction program was enacted under the HSWA, they are enforceable by the EPA. Identification of restricted wastes, schedules for evaluating wastes for restrictions, applicable treatment standards, and requirements for generators and TSD facilities managing restricted waste are contained in Title 40 CFR Part 268 and WAC 173-303.

The development of treatment standards for LDR waste was achieved by the EPA assessing the BDAT for each waste. Constituent concentration limits

established by BDAT were then compared to risk-based standards. If BDAT levels were equal to or lower than the risk-based levels, EPA then issued the treatment standard based on the risk-based levels. If application of BDAT resulted in levels above the risk-based standards, but the technology would substantially reduce the mobility and toxicity of the waste, EPA then issued treatment standards based on BDAT. In this latter instance, the risk-based standard would remain an EPA goal that could be achieved by development of new technologies. Specific treatment standards for Federally restricted wastes are contained in Tables 2 through 7 in the Appendix.

4.1.2 Washington State Restrictions

The Washington State Department of Ecology has promulgated land disposal restrictions specific to Washington State hazardous waste facilities such as those found on the Hanford Site. The regulations applicable to the State program are contained in WAC 173-303-140. Currently, these requirements are very limited in scope. However, it is anticipated that the state will apply for authorization of the federal land disposal program. When this occurs, it is anticipated that this section of the regulations will be expanded to become as stringent or more stringent than the current Federal program.

Table 8 in the Appendix contains a listing of waste types that are restricted from land disposal in the State of Washington. Of these waste types, liquid waste and ignitable and reactive wastes are restricted by EPA as well. The remaining waste types are uniquely banned under a state regulation.

Solid acid wastes are also banned from land disposal in the State of Washington. The regulations are not specific regarding how such wastes must be treated or to what levels. Thus, it can be assumed that treatment of such wastes to non-acidic levels (pH>2.0) would be required in land disposal of this type of waste.

Organic/carbonaceous wastes consist of wastes that contain combined concentrations of >10 percent organic/carbonaceous constituents which are those that contain carbon-hydrogen, carbon-halogen, or carbon-carbon chemical bonding. These types of wastes must be incinerated "as a minimum management method" in the State of Washington or they must be shipped out of state for further waste management.

Leachable inorganic wastes are banned from land disposal in the State of Washington and are defined as solid dangerous wastes that are not an organic/carbonaceous waste and exhibit the characteristic of extraction procedure (EP) toxicity. These types of wastes must be stabilized as a minimum management method or lab packaged if they are in small containers.

4.2 MIXED WASTESTREAMS POTENTIALLY SUBJECT TO LAND DISPOSAL RESTRICTIONS

The solid RMW streams generated at the Hanford Site have been evaluated for the potential to contain LDR waste and are discussed in the sections that follow.

The Hanford Environmental Health Foundation (HEHF) does not generate RMW; therefore, there is no discussion regarding their wastestreams.

Most plants accumulate RMW in an approved satellite accumulation area before shipment to the HCWC, unless the facility has been approved for interim storage, or has applied for a permit to store the waste.

4.2.1 PUREX Radioactive Mixed Wastestreams

The Plutonium Uranium Extraction (PUREX) Plant located in the 200 East Area is used to reprocess spent reactor fuel from the N Reactor. The PUREX process uses a nitric acid solution to dissolve the fuel and then a solvent extraction process using tri-butyl phosphate (TPB) in a normal paraffin hydrocarbon (NPH) diluent to separate the various fission products from the uranium, neptunium, and plutonium product streams. During the process cycle, various aqueous wastestreams are created and piped to storage tanks for neutralization and/or decontamination. These wastes are then piped to underground storage or to cribs. Solid wastes are segregated and sent to the HCWC for interim storage. Only nonhazardous waste streams are currently discharged to cribs.

4.2.1.1 Solid Low-Level Waste. Radioactive solid waste is collected from all parts of the PUREX plant including the laboratory. The transuranic (TRU) portion is kept separate from the non-TRU portion termed LLW. Some of the waste, such as mercury-filled light tubes, rags, and aerosol cans, are definitely hazardous and separate collection receptacles are established for collection of those wastes. To ensure that hazardous waste is not inappropriately discarded with the LLW or TRU waste, the waste is sorted before packaging and shipment to the HCWC.

4.2.1.2 PUREX Tunnels 218-E-14 and 218-E-15. These tunnels are "interim" container storage systems for RMW. This waste contains amounts of lead, mercury, and silver nitrate. The flatbed railcars used as storage areas in the tunnels are considered separate containers and are described as "miscellaneous units" per 40 CFR 264 Subpart X (proposed rule) (DOE 1988c).

4.2.2 Plutonium Finishing Plant Radioactive Mixed Wastestreams

Several RMW streams are generated routinely at the PFP and may meet LDR criteria. These wastes, discussed in the sections that follow, include solid wastes shipped to the HCWC.

4.2.2.1 Solid Waste Containing PCBs. In the past the PFP complex operated several PCB hydraulic systems in radioactively contaminated areas. These areas generated large amounts of PCB-contaminated radioactive waste. Currently wastes are generated through routine maintenance on the hydraulic systems, through periodic flushes of the systems mandated by the Toxic Substances Control Act (TSCA), and from PCB-contaminated light ballasts. Many of the 180 drums of PCB-RMW stored at the HCWC have been generated at the PFP.

4.2.2.2 Solid Waste Containing Fluorescent Light Tubes. Fluorescent light tubes containing mercury are used in processing gloveboxes and radiation areas throughout the PFP facility and are managed as mixed waste MW). This wastestream has been considered to be EP Toxic and therefore may fall under LDR restrictions in May 1990. This waste is shipped to the HCWC.

4.2.2.3 Solid Wastes Containing Lead Metal. Lead gloves and lead glass shielding are routinely used throughout the PFP complex to reduce occupational radiation exposure levels. Lead-lined gloves on processing gloveboxes are routinely changed out to minimize the potential for glove failures which could lead to the spread of radioactive contamination. Approximately 15 drums of lead glove waste are generated each year at the PFP. Lead glass windows are infrequently changed during maintenance activities; however, no estimate of generation rates for this material is available. These wastes are shipped to the HCWC.

4.2.2.4 Laboratory Solid Wastes Containing Xylene and Toluene. Laboratory wastes containing xylene and toluene are generated during the analysis of samples for neptunium and plutonium. These wastes are packaged and shipped as solid waste to the HCWC and stored in the low flash point storage modules (see Section 4.2.1). While efforts are currently underway to find acceptable alternative analytical methods that will eliminate these solvents, these efforts have not been totally successful to date. Additionally, a small amount of xylene/toluene containing wastes from previous analyses is currently accumulating in a laboratory satellite accumulation area, before shipment to the HCWC.

4.2.2.5 Laboratory Solid Waste Containing Total Alpha Analysis Disks. Laboratory solid hood waste contains total alpha analysis disks that have been in contact with a solvent containing 10 percent ethyl ether. Since part of the analytical procedure involves volatization of the carrier solvent, no detectable amounts of ethyl ether remain on the disks. However, they may fall under LDR criteria due to their contact with a regulated solvent. These wastes are being interim stored until further determinations are made regarding disposal.

4.2.2.6 Laboratory Solid Waste Containing Emission Spectroscopy Standards. Laboratory solid standards used for emission spectroscopy of plutonium oxide or uranium oxide containing lead, cadmium, and silver in concentrations ranging from 1 to 1,000 ppm. These wastes may or may not be considered EP Toxic; analysis of the matrix will be required to determine if extract

concentrations from these wastes exceed the EP Toxic levels. These wastes are being interim stored until further determinations are made regarding disposal.

4.2.3 Uranium Oxide Plant Radioactive Mixed Wastestreams

Solid waste generated at the UO_3 Plant has the potential to be affected by the application of LDRs to RMW. Primarily, solvents used in radiation areas may cause materials to qualify as LDR-RMW. Other sources include contaminated light ballasts (PCBs) and fluorescent bulbs (mercury). Also, HNO_3 is used in large quantities as is H_2SO_4, both are listed as LDR. All RMW generated is shipped to the HCWC for storage.

4.2.4 Analytical Laboratories Radioactive Mixed Wastestreams

Potential LDR-RMW streams generated at the 222-S Analytical Laboratories located in the 200 West Area are discussed below.

4.2.4.1 Radioactive Solid Waste. This stream consists of miscellaneous laboratory solid waste including compactible/combustible, glass and metal materials. Included in this stream is radioactively contaminated lead, outdated solid commercial chemicals, and lead-shielded waste from laboratory hot cell operations containing vials and absorbent materials that have been soaked in nitric acid and rinsed with water. Also included in this wastestream are vials and absorbent paper products from hood operations that have been in contact with hazardous materials. This stream is possibly RMW and LDR and is currently shipped to the HCWC.

4.2.4.2 Radioactive Mixed Liquid Waste. This stream is generated during radiochemical separation procedures. This organic liquid waste (xylene and toluene) is separated from the aqueous phase and collected in slurp bottles. The full slurp bottle is taken to the satellite storage area until eight gallons is accumulated. The material is lab packed and shipped to the HCWC for interim storage. Unknown organic waste is currently stored in a permitted storage facility until sampling and analysis are complete. This stream is considered RMW and LDR.

4.2.5 The B Plant Radioactive Mixed Wastestreams

The B Plant does not have any process oriented solid wastestreams. Maintenance activities generate small quantities of solid waste such as lead shielding, small equipment decontamination agents, paint and paint supplies, and fluorescent light ballasts. These wastes are generated on an as needed basis as a result of plant maintenance and are not directly related to B Plant processing.

4.2.6 The T Plant Radioactive Mixed Wastestreams

Solid wastes generated at T Plant include lead storage batteries, metallic vapor lights, aerosol cans, and paint cans. Hazardous wastes are segregated from nonhazardous solids and may be considered LDR, depending on the characteristics of the waste.

4.2.7 The 100 N Area Radioactive Mixed Wastestreams

There are numerous possible sources within the radiation control zones of 100 N Area that generate waste oils, solvents, decontamination solutions, laboratory chemicals, etc., that have in the past been designated as RMW that also may be LDR. Approximately 923 m^3 of wastes from the 183-H Basins are yet to be removed or are on satellite storage pads. This waste will be stored at the HCWC pending final RCRA disposal.

4.2.8 The 300 Area Fuels Manufacturing Radioactive Mixed Wastestreams

The facilities that generate these streams have for the most part been shut down since 1987. However, solid wastes are being generated primarily from the cleanup of these facilities.

4.2.8.1 Waste Oil. Past waste analyses have shown that some lubricating oils are radioactively contaminated with uranium as well as being hazardous. This waste is being interim stored pending the study of RCRA disposal options.

4.2.8.2 Waste Acid Treatment System Waste. The 300 Area Waste Acid Treatment System generates RMW material from the centrifuge and filter press operations. This waste is being interim stored pending the study of RCRA disposal options.

4.2.8.3 The 303-M Oxide Facility Waste. The 303-M Oxide Facility is the only facility for which operation will likely occur in the future. This facility is intended to treat ignitable waste by calcination. A RCRA Part B permit application is being prepared for this facility.

4.2.8.4 The 303-K Mixed Waste Storage Facility Waste. The 303-K Mixed Waste Storage Facility has been storing LDR-RMW for over a year. The RMW consists of perchlorethylene absorbed on conweb pads. There is a potential that the perchlorethylene-soaked pads also contain ethyl acetate. Waste acid (HF and HNO_3) absorbed on "Kitty Litter" and containerized, HF and HNO_3 absorbed in acid crystals of copper fluorozirconate and containerized, and 333 Building waste oil with organic halides contained in drums are also stored in this facility. This waste is being interim stored pending the study of RCRA disposal options. A Part A permit has been filed for this facility.

4.2.8.5 The 305-B Facility. The 305-B Mixed Waste Storage facility is an interim storage facility for scintillation cocktails and tissue sample preparations. The waste is accumulated in satellite storage areas and placed in less than 90 day storage prior to shipment to the HCWC.

4.2.9 Advanced Reactor Development Facilities Radioactive Mixed Wastestreams

Transition of fuel fabrication activities from the 308 Building in the 300 Area to the Fuels Materials Examination Facility (FMEF) in the 400 Area is currently scheduled for completion in FY 1990. Additional programs are currently scheduled to be established in the FMEF and include the Radioisotope Power System Facility (RPSF) and possibly the Space Isotope Program (SIP). The RPSF radioactive wastestreams will be limited to solid wastes while current SIP-related process wastestreams are not anticipated to be LDR. All operations in FMEF are anticipated to result in some quantities of maintenance-related LDR-RMW associated with the use of listed solvents.

Identified LDR-RMW associated with current operations are solid waste. These wastes will be subject to full characterization before the storage at the HCWC and treatment in the WRAP Facility (when operational) or, in the case of some sodium waste, in the Maintenance and Storage Facility (MASF). A discussion of the potential LDR-RMW streams generated by the Advanced Reactor Development facilities follows.

4.2.9.1 Waste Sodium. Waste sodium is associated with Fast Flux Test Facility (FFTF) operations and developmental work performed at the 324 Building located in the 300 Area. Waste sodium exhibits the characteristic of reactivity, and therefore will be LDR in May 1990.

4.2.9.2 Sodium-Contaminated Waste. Sodium-contaminated piping systems, support equipment, and FFTF reactor components exhibit the characteristic of reactivity due to the presence of residual sodium, and therefore will be LDR in May 1990.

4.2.9.3 Spent Ethyl Alcohol Waste. Spent ethyl alcohol is generated in the processing of Material Open Test Assembly (MOTA) specimens to react the residual sodium. The waste exhibits the characteristics of ignitability and corrosivity, and therefore will be LDR in May 1990. This waste is being interim stored pending the study of RCRA disposal options.

4.2.9.4 Listed Solvent Residuals. Listed solvent residuals contain quantities of 1,1,1- trichlorethane, acetone, methylene chloride, and methyl ethyl ketone. These wastes are associated with plant maintenance activities such as manipulator repair and painting. These wastes have potential concentrations above LDR limits at the point of generation. These wastes are presently LDR since they contain spent solvents listed in 40 CFR 268.30. This waste is being interim stored pending the study of RCRA disposal options.

4.2.9.5 Contaminated Lead Residuals. Contaminated lead residuals from lead decontamination will likely exhibit the characteristic of EP Toxicity and therefore will be LDR in May 1990. This wastestream may also be state LDR since the residuals may be an Extremely Hazardous Waste (EHW) under WAC 173-303. This waste is being interim stored pending the study of RCRA disposal options.

4.2.9.6 Decontamination Wastes. Waste will be generated in the process of decontamination of stainless steel components such as shipping casks and hot cells or other equipment in the conduct of FMEF operations. These wastes are potentially LDR because of the presence of nickel, chromium, silver, methylene chloride, and commercially used solvents. This waste is being interim stored pending the study of RCRA disposal options.

4.2.10 Pacific Northwest Laboratory Radioactive Mixed Wastestreams

Most RMW generated at PNL is stored either at the HCWC or in DSTs. The PNL has limited storage capacity for certain types of RMW at its permitted storage facility (305-B). The RMW and their destinations identified at PNL using historical records and process knowledge are potentially subject to land disposal restrictions.

Most laboratory RMW streams currently generated from PNL facilities are characterized by small volume, from a few milliliters to several liters, and are contained in laboratory apparatus. These waste streams result from research operations and usually can be fully characterized by process knowledge. When testing is required, it normally consists of pH and flashpoint measurements.

4.2.10.1 Solid Laboratory Waste From 303-C Building. Solid laboratory waste from 303-C consists of contact-handled, beryllium-contaminated waste from 303-C Building. This waste is stored at the HCWC.

4.2.10.2 Solid Laboratory Waste From 324 Building. This is contact-handled, EP-toxic, solid laboratory waste from the 324 Building and is stored at the HCWC.

4.2.10.3 Solid Building Maintenance Waste. This is contact-handled, PCB-containing solid waste from building maintenance and is stored in the HCWC.

4.2.10.4 Solid Laboratory Wastes From 325 Building. This is contact-handled, EP-toxic, acidic (pH<2.0), toxic (Washington State), solid, low-level laboratory waste (that may or may not be ignitable) from the 325 Building and is stored at the HCWC.

4.2.10.5 Solid Transuranic Laboratory Waste From 325 Building. The 325 Building generates solid TRU laboratory wastes that are contact-handled, may or may not be ignitable, EP-toxic, acidic (pH<2.0), toxic (Washington State), solid TRU laboratory waste from the 325 Building and is stored at the HCWC.

4.2.10.6 Solid Laboratory Waste From 326 Building. This is contact-handled, EP-toxic, solid laboratory waste from the 326 Building and is stored at the HCWC.

4.2.10.7 Solid Low-Level Laboratory Waste From 327 Building. Two separate solid low level laboratory wastes are generated in the 327 Building: contact-handled and remote-handled, EP-toxic (RCRA), acidic (pH<2.0), toxic (Washington State), solid, low-level laboratory waste from the 327 Building and is stored at the HCWC.

4.2.10.8 Solid Transuranic Laboratory Waste From 327 Building. This waste is remote-handled, EP-toxic (RCRA), acidic (pH<2.0), toxic (Washington State), solid, TRU, laboratory waste. This waste is currently interim stored.

4.2.10.9 Solid Laboratory Waste From 320 Building. This is contact-handled, EP-toxic (RCRA), solid, laboratory waste [that may or may not be ignitable (F003,F005)] and is stored at the HCWC.

4.2.10.10 Solid Laboratory Waste From 331 Building. This is contact-handled, EP-toxic (RCRA), acidic (pH<2.0), toxic, carcinogenic, persistent (Washington State), solid laboratory waste (that may or may not be ignitable) and is stored at the HCWC.

4.2.10.11 Solid Waste From 3720 Building. This is contact-handled, EP-toxic, acidic (pH<2.0), toxic, carcinogenic, persistent (Washington State), solid laboratory waste stored at the HCWC.

4.2.11 Tank Farms Radioactive Mixed Wastestreams

The solid wastestreams from Tank Farms operations will consist of characterization samples and hardware such as instrumentation or motors from SST and DST waste sampling and/or treatment and disposal efforts, failed equipment, and mercury, lead, caustic, solvent, or acid contaminants. Some may be LDR-RMW.

This page intentionally left blank.

5.0 MIXED WASTE MINIMIZATION, TREATMENT, STORAGE, AND DISPOSAL ACTIVITIES AT THE HANFORD SITE

Radioactive mixed waste TSD options are dependent on accurate forecasting of the waste volumes, as well as the characterization of those volumes. Several activities are underway to gain this information. In the *Rocky Flats Plant Federal Facility Agreement and Consent Order* (DOE 1989a), the DOE committed to preparing a report entitled, *National Report on Prohibited Waste and Treatment Options*, to be submitted to the EPA in January 1990. Input to this report for the Hanford Site was given in October of 1989.

Projected future waste volumes suitable for treatment, after compaction or size reduction, have been estimated at 73,640 m^3 (assuming WRAP Module I operation) from 1999 to 2017 (see Table 5-1). The projected total volume of RMW from FY 1989 to FY 2017, including stored and newly generated LL-RMW and TRU- RMW, is estimated at 11,942 m^3. Of this amount, no reliable predictions have been made as to the status of LDR constituents. No figures are given for LLW storage as it is disposed upon receipt rather than stored.

Packages of RMW are accepted at the Hanford Site 200 Area facilities for storage in the HCWC and for future treatment in the WRAP Facility. Chapter 5.0 of the *Hanford Site Radioactive Solid Waste Acceptance Criteria*, WHC-EP-0063-1 (Stickney 1989), contains the minimum criteria for identifying, packaging, labeling and marking, and documenting RMW to meet the regulations promulgated by the EPA, Ecology, and DOE-RL. These criteria assure that RMW constituents are identified prior to receipt of the waste package.

A waste minimization program is required for regulatory compliance and is a significant contributor to cost effective and prudent RMW management. Hanford Site minimization activities range from process examinations for minimize RMW generation at the source to segregation activities and reporting activities.

The Hanford Site is planning to develop treatment capability for RMW through the WRAP Facility for low-level and TRU containerized waste, estimated to start operations in 1996 for Phase I and 1999 for Phase II.

The WRAP Facility will have the capability to perform various treatment technologies including stabilization. Types of RMW that have a potential for treatment at the WRAP Facility include:

- Elemental lead that can be stabilized or surface decontaminated
- Stabilization of ion exchange resins
- Heavy metal-containing waste to be stabilized
- Stabilization of miscellaneous hazardous waste liquids, solids, and particulates.

Table 5-1. Summary of Current and Newly Generated Waste Volumes.

	CH-TRU	RH-TRU	LL-MW and TRU-MW
Current[a] storage	349,600 ft^3[b] (9,901 m^3)	4,850 ft^3 (137 m^3)	65,058 ft^3 (1,842 m^3)
Newly generated (1989-2013)	126,433 ft^3 (3,581 m^3)	36,680 ft^3 (1,038 m^3)	356,631 ft^3 (10,100 m^3)
Totals	476,033 ft^3 (13,482 m^3)	41,530 ft^3 (1,176 m^3)	421,689 ft^3 (11,942 m^3)

[a]As of December 31, 1988.
[b]Does not include waste expected to be reclassified as LLW.

Data on all waste buried or stored on the Hanford Site have been input to the Richland Solid Waste Information Management System (R-SWIMS) data base that resides on the NAS6620 mainframe computer using hierarchical NOMAD* 2 Database Management System software. The purpose of the database is to track all radioactive solid waste that has been buried or stored in the 200 East Area and 200 West Area burial grounds from 1944 to the present. The database is being modified to add the capability to track shipments from the point of generation and shipper to final disposition.

The data in the database are based on information entered on the Solid Waste Storage Record (SWSR) and input into the Richland-Solid Waste Information Management System (R-SWIMS). The information on the SWSR, other than container size and weight, was based on a per-shipment basis (from 1970 through 1981) and since 1982 has been on a per-container basis. Information in the SWSRs has changed over the years as requirements, regulations, and the increased need for more complete characterization arose.

5.1 WASTE MINIMIZATION

The DOE Office of Defense Programs (DP) has issued a Waste Minimization Policy specifying avoidance of the generation of radioactive, hazardous and mixed wastes, and reduction in the toxicity of wastestreams containing hazardous components. In addition, where wastes are unavoidably generated, attempts should be made to recycle or reuse all or part of the wastestream component, and to treat non-reusable waste to reduce toxicity and/or volume.

*Nomad is a trademark of U3S International, Ltd.

The policy further states that waste minimization must be considered when planning future activities, such a designing a new facility, decontamination and decommissioning, and conducting site environmental remedial actions.

To coordinate implementation of this policy, the DP formed a Waste Reduction Steering Committee (WRSC) composed of representatives from the Offices of Defense Waste and Transportation Management (DWTM), Weapons Safety and Operations, Weapons Production, Weapons Research, Development and Testing, and Nuclear Materials Production. The Committee is chaired by a representative of the DWTM. Committee objectives include maximizing information exchange, identifying current and future data needs and reporting requirements, and guiding future activities between DP organizations and their sites. The Committee meets twice yearly. Meeting dates for 1989 were in January and August. Westinghouse Hanford was represented at the August meeting and presented information relating to the Hanford Waste Minimization Program.

To understand current waste minimization activities in the field, the WRSC is visiting each DP waste-generating and management site, including Hanford. Objectives for each visit include:

- Reviewing waste generation and/or packaging operations to determine the level of commitment by operations and waste management personnel to waste minimization and reduction
- Determining the status of system-wide waste reduction activities and progress
- Obtaining information to develop a method for a Success Demonstration consistent with ongoing and planned site activities
- Assisting the WRSC in developing guidance and requirements for system-wide waste reduction.

The cost of waste minimization can be substantially reduced by sharing ideas and technology. Monthly meetings among the major waste generators to discuss waste management issues have been established at Hanford. The goal is to reduce costs by the elimination of redundant work in different plants that share a similar problem. The DOE-RL also participates in national DOE waste minimization workshops. In addition, on December 15, 1989, the Idaho and Richland Operations offices of DOE signed a five year joint agreement to collaborate on the development of waste management and environmental restoration technologies. The agreement runs through September 30, 1994 and includes the involvement of DOE contractors as well as the states of Washington, Oregon, Idaho, and Montana. The agreement outlines nine specific areas of collaboration:

- Stabilizing or destroying waste on location
- Quantifying potential health and environmental risks and exposure reductions

- Processing wastes to recover potentially useful materials
- Treating solid and liquid waste using high temperatures
- Developing robotic waste retrieval technologies
- Differentiating specific waste sites
- Demonstrating technologies
- Developing waste minimization techniques
- Collaborating with universities on research and training.

The Hanford Site also participates in corporate and DOE contractor information exchanges related to waste minimization. In addition, national conferences and conventions are supported to ensure that a wide variety of technologies are evaluated for potential application at Hanford Site facilities. A Waste Minimization Workshop was held at Hanford, sponsored by Westinghouse, September 7-8, 1988, to foster information exchange.

Waste minimization practices minimize or eliminate the amount of waste that must be treated, stored, or disposed of and result in either the reduction of the total volume of waste, or the reduction of the toxicity of the waste, or both, as long as the reduction is consistent with the general goal of minimizing present and future threats to human health and the environment.

The overall implementation of waste minimization for the Hanford Site is the responsibility of DOE-RL. Each contractor will develop and implement their own waste minimization program. Site-wide reports, such as the EPA Biennial Waste Minimization Report, will be coordinated by Westinghouse Hanford for DOE-RL with input from each contractor.

The initial Biennial Waste Minimization Report, required by the EPA, was compiled and issued in 1988. Preparatory work has been completed for the next report with issuance to occur in FY 1990. A draft Site Waste Minimization and Pollution Prevention Awareness Plan has been completed in response to the DOE Draft Waste Reduction Policy and Waste Minimization Guidance. This document is currently under review and, when issued, will provide recommendations on the aspects of an effective waste minimization plan.

The Hanford Site has numerous waste generation points. The larger and more diverse contractors have chosen to require more detailed waste minimization plans to be written for the waste generating facility or at the activity level. The plans will outline the specific programs within each organization for minimizing waste. Included in these plans will be requirements for defining responsibility for waste minimization at the facility (or for the activity), baselining waste generation rates, establishing waste stream reduction goals, and development of specific training programs.

A key aspect of these plans is the practice of waste segregation. All radioactive waste generating facilities are required to implement a plan for the segregation of RMW from other solid waste such as TRU, LLW, and hazardous waste. The DOE direction for segregation of RMW from other radioactive solid waste is based on RCRA and the WAC. The segregation is required to support commitments to implement programs developed to secure compliance with regulatory waste management requirements and to provide the documentation necessary for waste acceptance at Hanford Site waste facilities.

The LLW Certification Review Committee, which is composed of members from cognizant organizations, has been established to provide an administrative program overview. Plans will be reviewed by the committee and the required changes discussed with the generating facility managers. Waste generating facility managers will submit their facility waste segregation compliance plan to the committee for formal review and approval.

Specific waste minimization activities to date involving LDR-RMW or potential LDR-RMW waste include the following (Greenhalgh 1989):

- Waste segregation

- Solid waste segregation, recycling, and compaction at the N Reactor facility

- Hazard level reduction

- Deregulation of Hanford Site electrical transformers by replacing PCB-contaminated oil with recycled "clean" oil

- Replacing laundered oil treated mops with non-oil treated mops, thus avoiding a candidate LDR-RMW stream

- Process Improvements

- Elimination of a candidate LDR-RMW in a 222-S Laboratories wastestream by replacing xylene/toluene scintillation fluids with Ultima-Gold scintillation fluid, resulting in a reduction of 22 ft^3 per year of candidate LDR-RMW

- Jumper piping in PUREX was installed using 615 lb of steel weights instead of 615 lb of lead (State LDR); other equipment had 100 lb of lead replaced with 100 lb of steel for a total of 715 lb of candidate LDR-RMW reduction.

5.2 TREATMENT

Hanford Site waste management operations is responsible for the treatment of radioactive and mixed liquid and solid wastes. Wastes are treated by generators where feasible (e.g., neutralization and/or absorption prior to receipt at the HCWC). Most non-radioactive hazardous waste is shipped offsite for treatment and disposal. Various waste treatment processes are required prior to waste disposal depending on the radioactive type (HLW, LLW, or TRU waste), physical nature, and chemical composition.

Treatment will be centered at the HCWC. The mission of the HCWC will include the processing and/or treatment of both retrievably stored and newly generated waste (when WRAP is operational).

The HCWC will process the following types of wastes:

- Stored and newly generated suspect contact-handled transuranic (CH-TRU) wastes packaged in drums and boxes awaiting repackaging, certification, and shipment to the Waste Isolation Pilot Plant (WIPP)

- Newly generated suspect LLW for final packaging coupled with volume reduction, certification, and disposal

- Contaminated small equipment and hardware that may be reclassified (e.g., TRU to LLW) or returned to service via decontamination processes

- Stored and newly generated suspect remote-handled transuranic (RH-TRU) wastes to be packaged into the RH shipping container, certified, and stored awaiting final certification for shipment to WIPP

- Retrievably stored RMW

- Newly generated hazardous wastes for in-house treatment, packaging, and onsite disposal or packaging and certification for offsite treatment and disposal

- Newly generated RMW, including liquid organics (if packaged using lab packs, absorbent, or otherwise stabilized), sludges, and wastes that contain hazardous metallic components
- Ion exchange resins
- Animal wastes
- The PCB waste contaminated with radioactive material; this waste may be packaged for treatment at another DOE Facility such as the Los Alamos National Laboratory (LANL) or the Idaho National Engineering Laboratory (INEL)
- Classified wastes that require special processing before disposal
- Research reactor fuel that may be designated as LLW or TRU waste
- Soils recovered as part of TRU waste retrieval operations
- Characterization samples and hardware such as instrumentation or motors from single- and DST waste programs.

The planned WRAP plant will provide treatment operations for radioactive and/or suspect hazardous solid wastes. The WRAP complex will consist of solid waste treatment processes and buildings constructed under two separate projects termed as modules. Module I will provide CH drum handling, transuranic package transporter (TRUPACT)-II shipping, and Administrative (offices and personnel change rooms) facilities. Module II will provide facilities for size reduction, decontamination, remote handling, and low-level mixed waste (LLMW).

The WRAP Module I is to provide examination, certification, and shipping facilities for CH-TRU and suspect CH-TRU solid waste drums and boxes. Module I will also open, sort, and process (limited) waste drum contents. Retrieved and newly generated CH suspect TRU waste in drums and small boxes (e.g., standard waste boxes) will be routed to Module I. Drums with high dose rates, contaminated soil, TRU boxes determined as non-compliant, or security declassified contents will not be handled within Module I. Decontamination services for small items (i.e., items that can fit into a 55-gal drum) is planned with the intent of providing services for lead recovery and decontamination of drums and overpacks. A special processing facility (consisting of a designated enclosure) for non-compliant waste items will be provided for in a specific disposal waste form acceptance treatment.

The WRAP Module II is planned to process all the retrieved and newly generated CH suspect TRU waste in boxes and other containers, as well as drums with high dose rates, RH waste forms with dose rates >200 mR/h, contaminated soil, LLMWs, or security classified content wastes. The WRAP Module II will consist of four facilities which are: a Size Reduction Facility, a Decontamination Facility annexed to the Size Reduction Facility (SRF), a Remote Handling Facility, and a Mixed Waste Treatment Facility (MWTF).

The WRAP Module II will handle RMW as either TRU-RMW or LL-RMW. The Draft Engineering Study for WRAP Module II discusses the WIPP Waste Acceptance Criteria (WIPP WAC) for TRU-RMW; each TRU waste package received at the WRAP facility will be examined for RMW and contents treated as necessary to meet the WIPP and WAC standards. Corrosives will be neutralized or packaged for container integrity and all hazardous components must be reported and labeled.

Low-level RMW, including LDR-RMW, expected to be treated in WRAP is also discussed in the Engineering Study as well as the probable BDAT expected to be applied to the particular wastestream. The probable BDAT to be employed includes metal stabilization by reduction or oxidation, incineration (offsite), and neutralization.

The Mixed Waste Treatment Facility (MWTF) will provide the necessary LLMW treatment processes to enable disposal in accordance with all applicable regulations. The MWTF will provide LLW pretreatment and solidification of metallic wastes, lead melting, and solidification of sludge and ion exchange resins. The LLMW requiring incineration will be repackaged and transported to the Idaho National Engineering Laboratory for treatment.

Some RMW will require treatment and disposal offsite. Possible RMW in this category includes the following:

- Solvent RMW
- Ignitable PCB-containing MW
- Lead requiring reclamation.

Hanford actions will be to meet offsite waste acceptance criteria when shipments are to be made.

The SRF will consist of a shielded enclosure with an associated receipt and loading enclosure and operational support areas. The SRF will process all the drums that contain contaminated soil, security classified wastes, RH wastes, all retrieved waste boxes, and waste in "other containers." Operations in the process enclosure will be performed remotely from an operating gallery using manipulators, positioning tables, and cranes controlled via closed circuit television/viewing windows. Received waste and containers will be reduced in size and weight to fit into 48-gal drum liners and loaded out into new Department of Transportation (DOT) specified 55-gal drums. Waste will be segregated dependent on the waste category. Waste materials requiring further processing such as shredding, grouting, solidification, and immobilization will be packaged for transfer to the Special Processing operational area within the WRAP facility.

The Decontamination Facility will provide decontamination and repair services for WRAP facility and other facilities in the 200 Areas. The Decontamination Facility will, essentially, "cut up" equipment that can not be returned to service and transfer the "pieces" to the SRF.

The WRAP Module II RH Facility will process retrieved and newly generated RH TRU and LLW RH wastes via separate processing campaigns. Waste processing will include waste receipt, assaying, smear sampling, plasma melting, radionuclide nondestructive analysis (NDA) measurement, repackaging, canister welding, and cask handling.

5.3 STORAGE AT THE HANFORD CENTRAL WASTE COMPLEX

The Hanford Central Waste Complex (HCWC) currently provides storage and will eventually provide treatment of solid wastes (when the WRAP facility is operational) at the Hanford Site. The HCWC will perform waste receipt, storage, repackaging, volume reduction, certification, treatment, and offsite shipment capability for a high percentage of solid TRU and RMW generated, stored, and received at the Hanford Site. Some newly generated LLW will also be processed in the WRAP facility when it is operational. All waste will be certified for disposal onsite or for shipment to an offsite disposal facility.

Wastes will be received at the HCWC facilities from onsite and offsite generators (including other Hanford Site storage locations such as TRU waste retrievable storage units [RSU] and caissons). Some waste, particularly RMW, will be stored at the HCWC before treatment and disposal to ensure compliance with federal and state regulations. Waste will be certified according to Westinghouse Hanford requirements for onsite disposal or other appropriate criteria for other disposal sites, such as the WIPP Waste Acceptance Criteria (DOE 1989c). Treatment will be performed as necessary for offsite shipment or onsite disposal.

The facilities within the HCWC are necessary for the Hanford Site to meet the following federal and state regulations for MW:

- The hazardous waste regulatory requirements of the RCRA and in the WAC 173-303
- The radioactive waste handling requirements of the U.S. Department of Energy (DOE) Order 5820.2A (DOE 1988c)
- The Toxic Substances Control Act (TSCA).

Collocation of solid waste handling facilities at the HCWC will also increase efficiency in waste handling by reducing transportation costs.

5.3.1 Hanford Central Waste Complex Facility Summary

The following facilities are included or planned for the HCWC.

- Flammable RMW Storage Modules. Eight modules are to be operational by the third quarter of FY 1990 to store flammable LLW, LLW-RMW, and TRU-RMW with flashpoints below 100 °F (38 °C). The total capacity can be 246, 55-gal drums. The modules are small pre-engineered buildings with 176 ft^2 each of floor space. Two modules are currently operational.

- Waste Unloading and Staging Area. This pad is 9,000 ft^2 in area and can hold approximately 2,500 drums stacked two high. This pad is not intended for long-term storage.

- RMW Storage Buildings (2402-W complex). The 2402-W and 2402-WB through 2402-WL Buildings (12 total) will all be operational by the second quarter of FY 1990 to store all categories of RMW (including TRU). The floor space of each building will be 4,000 ft^2. Each will have a 750-drum capacity with the exception of 2402-WG, which is planned for a 375-drum capacity for low flashpoint LLW. The first building to be operational was 2402-W in the third quarter of FY 1989.

- The 2401-W Mixed Waste Storage Building. In addition to RMW, the 2401-W Building is also used to store RMW and RMW contaminated with PCBs. Total capacity is 750 drums, with 4,000 ft^2 of floor space.

- Mixed Waste Storage Pad. The Mixed Waste Staging Pad is located adjacent to the RMW storage buildings and is used as an interim storage area.

- Large RMW Storage Facility. The large RMW Storage Facility, Project W-016H (2403-W, Phase 1), will be operational in four phases, from second quarter FY 1991 for Phase I through second quarter FY 1994 for Phase IV. They will store all categories of low-level RMW with 12,000 drums capacity each for Phases I, III, and IV buildings and 19,000 drums for Phase II (55,000 drums total).

- Waste Receiving and Processing Facility. The WRAP Facility will be constructed as two modules: the first (Project W-026) will be operational in the fourth quarter of FY 1996 and the second (Project W-100) in the fourth quarter of FY 1999. Module I (Building 2336-W) will have approximately 52,000 ft^2 of floor space while Module II is estimated at 85,000 ft^2. The WRAP facility will perform waste receipt, repackaging, certification, treatment, and volume reduction for LLW, TRU, LLW-RMW, TRU-RMW, and hazardous waste. Not all functions will be required for each waste type.

A conceptual layout of the HCWC facilities is shown in Figure 5-1. A plan view is given in Figure 5-2.

5.3.2 Radioactive Mixed Waste/Polychlorinated Biphenyl Storage Facility 2401-W

Before 1984, RCRA regulations were not considered by the DOE to apply to its defense facilities. An April 1984 court decision (LEAF vs. Hodel) ruled that all nonradioactive hazardous waste activities at DOE facilities were governed by RCRA. Additionally, in May 1987, DOE issued its final rulemaking acknowledging applicability of RCRA to the hazardous component of RMW. The asphalt pads in the burial grounds and in the HCWC were designated as non-compliant storage for RMW in November 1987. A January 14, 1988 letter from Westinghouse Hanford and DOE-RL to the EPA and Ecology documents a strategy for RMW storage for the Hanford Site. The strategy was developed to bring the Hanford Site into full compliance with applicable environmental regulations for the storage of solid RMW.

The primary statute for the regulation of PCBs is the Toxic Substance Control Act (Toxic Substances Control Act, 40 CFR 761, EPA, Washington, D.C.). The regulation requires analysis of all hydraulic systems if they are suspected of using PCB material. If PCB contamination is found, material removal and management must begin within six months. Material disposal and incineration is to take place in an approved facility within one year after generation. Treatment facilities currently exist for radioactively contaminated PCB waste, however, these facilities are not available for use because of various state restrictions. Hence, it is held in onsite storage awaiting treatment.

An initial inventory of PCB-RMW was performed in FY 1983. This waste was stored initially at the 212-P Radioactive PCB zone at the PFP. In 1987, it was recognized that a single storage facility was necessary for PCB-RMW for regulatory compliance and storage efficiency.

The strategy for PCB-RMW storage was to construct a permittable storage facility by May 1988. A site evaluation report was issued evaluating four sites within the 200 West Area for a PCB-RMW storage building. The recommended site was a location north of the 272-WA Building in the HCWC.

The 2401-W PCB/RMW storage facility was completed in May 1988. Stored in other facilities, the shipment of drums of PCB-RMW to 2401-W has been completed. The wastes will be stored until a facility is available for destruction. The LANL was originally chosen for destruction (by incineration) of PCB-RMW. A request for LANL incineration of Hanford PCB-RMW was made in 1985. However, recent actions by the state of New Mexico have closed this option at this time and the INEL is now being studied as an option.

Figure 5-1. Hanford Central Waste Complex Conceptual Layout.

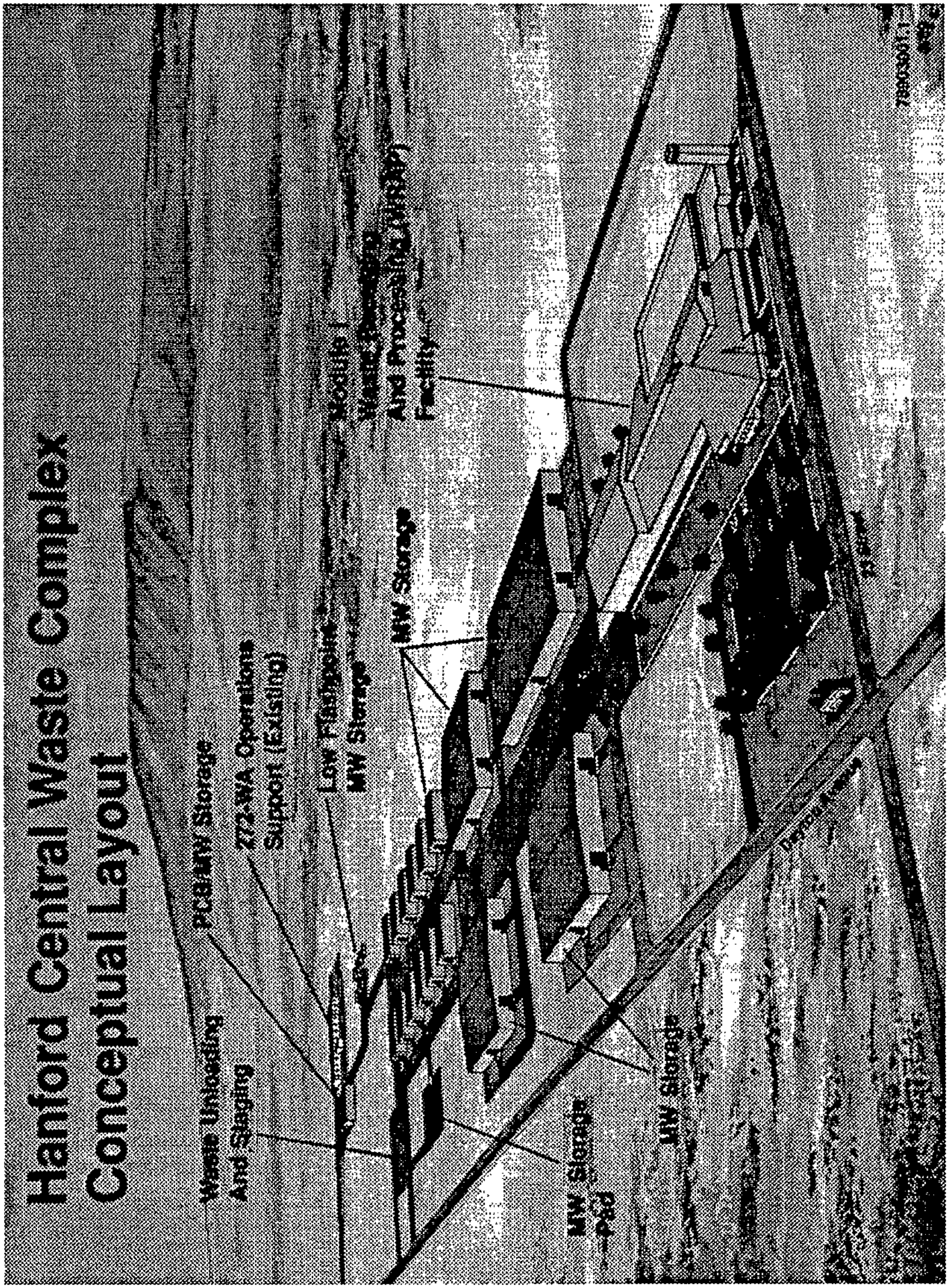
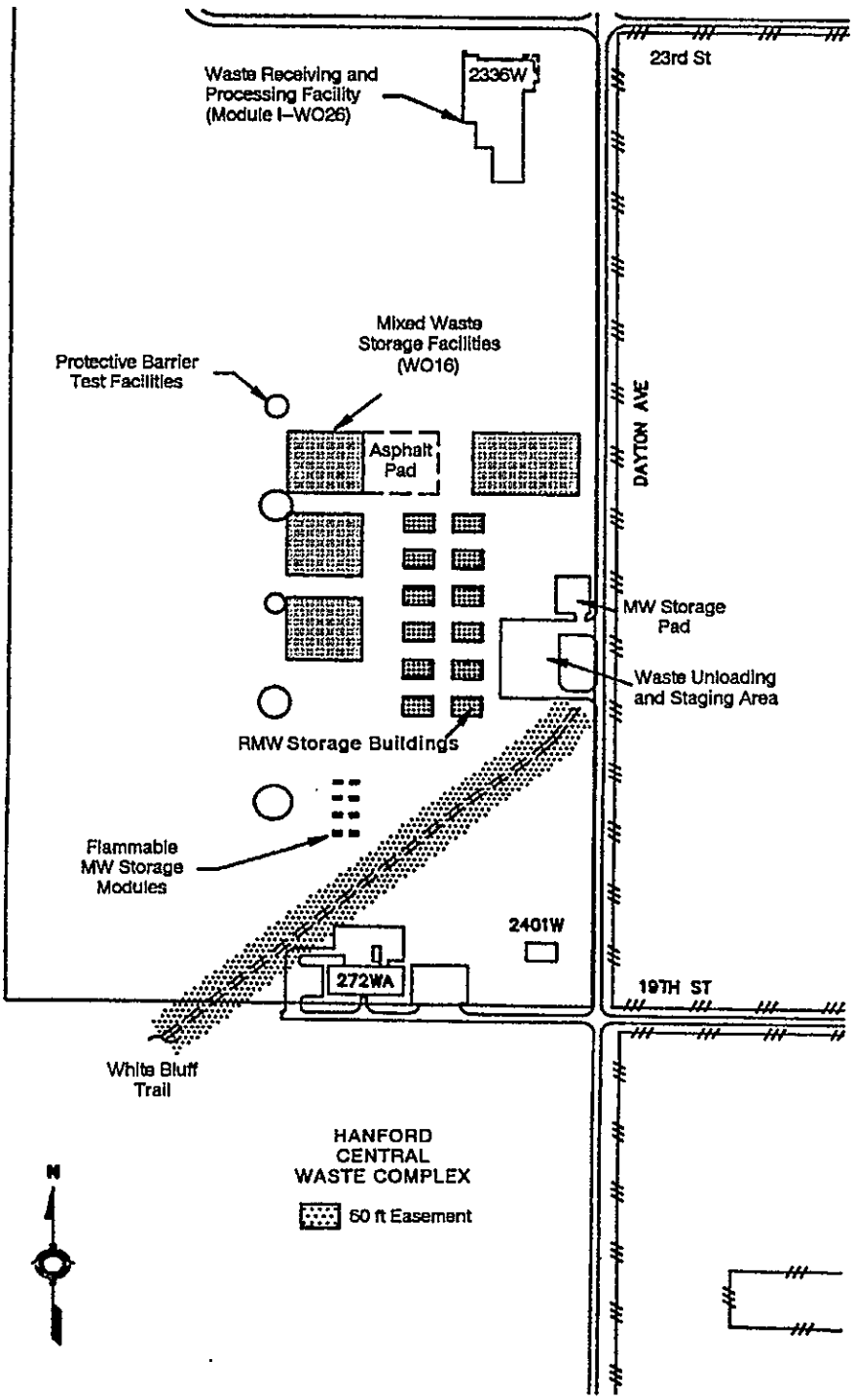


Figure 5-2. Plan View of Central Waste Complex.



5.3.3 Flammable Mixed Waste Storage Modules

The HCWC also has eight storage modules for flammable RMW. Of these storage modules, two were installed by January 1988 and six more delivered. Storage was initiated in October 1988.

The low flashpoint storage modules have provided an effective storage mechanism for low flash point RMW. However, the cost per unit volume of stored waste is excessively high. The storage cost per drum is $2,490 or $396/ft^3, five to ten times higher than a larger facility that could incorporate economies of scale. A study was published to recommend an alternative to continued use of the modules. The alternative was to use one of the proposed 4,000 ft^2 RMW storage buildings planned for the HCWC. This will meet current projections (although new waste projections are likely to change future storage requirements) for low level TRU-RMW, non-vented waste.

5.3.3.1 Building Description. The flammable storage units consist of small pre-engineered buildings. A typical building is shown in Figure 5-3. The storage modules are 22 ft and 8 in. by 9 ft by 8 ft and 7 in. (exterior dimensions). The modules each have 176 ft^2 of floor space and weigh 20,000 lb.

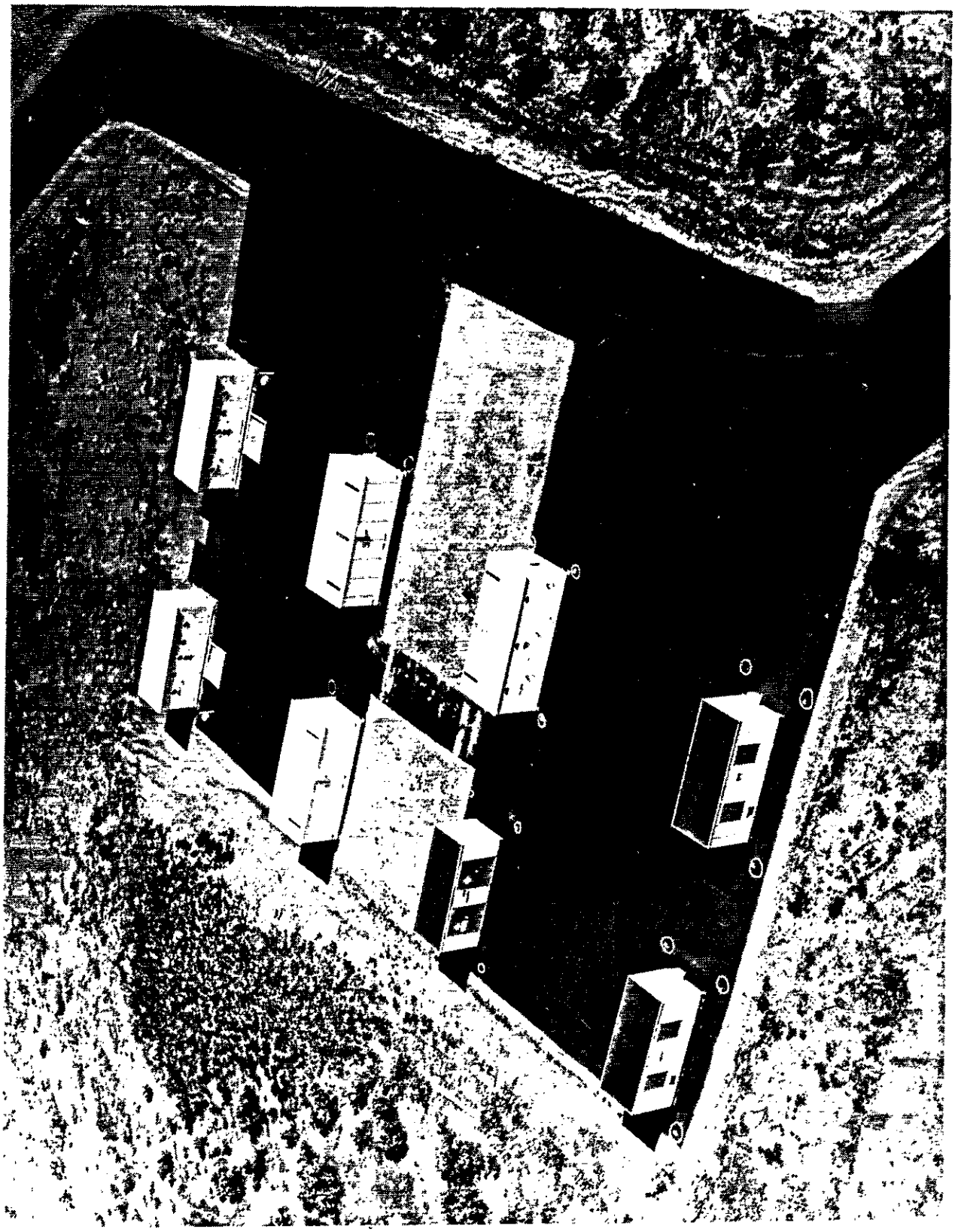
An internal 570-gal capacity spill containment reservoir is provided under the flooring. This spill-holding capacity exceeds the secondary containment requirements mandated in WAC 173-303. The flooring is equipped with removable panels to permit visual inspection of the containment reservoir for area leaks or spills. A slip-resistant grit is applied to the top surface of each panel during the second application of epoxy paint. The floor support system is designed for loads up to 250 lb/ft^2.

The front, back, and side walls are constructed of either: 10-gauge steel or plywood coated with chemical-resistant fire retardant epoxy paint on the inside, both of which meet National Fire Protection Association (NFPA)-30 requirements. The roof is constructed of 12-gauge steel. The facility is draft ventilated. Electrical service and water supply are not provided.

Waste will generally be packaged in 55-gal drums and stored on a single tier within the modules. However, small containers may be stacked on top of the 55-gal drums, provided that the regulatory stacking limit of 63 in. is not exceeded.

Inspection of containers is required at least weekly to check for leaks and deterioration of containers. The low flashpoint storage modules meet the requirements of WAC 173-303, NFPA-30, and RCRA (40 CFR Part 261) for flammable liquids. The HCWC Emergency Plan contains procedures for emergency response and facility readiness for these modules. Each module is marked externally as containing flammable and radioactive materials. Fire extinguishers are provided and a fire water hydrant is located approximately 250 ft north of the modules for use in fire suppression.

Figure 5-3. Low Flashpoint Waste Storage Modules.



5.3.3.2 Waste Inventory. The module storage space is limited to approximately 246 drums, or approximately 23, 55-gal drums per module (it is expected that 40 drums can be stored per module using 30-gal drums).

5.4 DISPOSAL

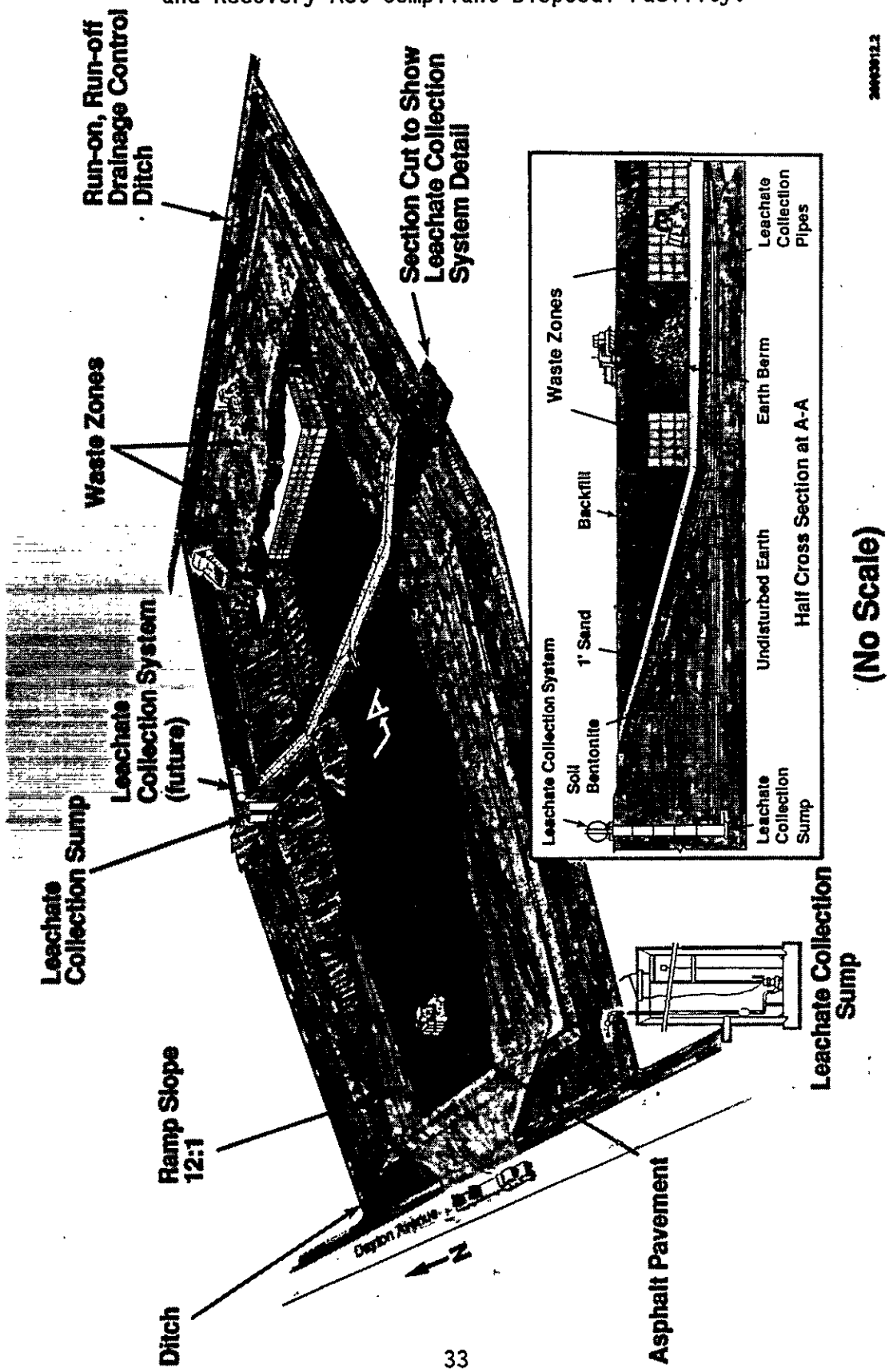
The option of disposal is the least acceptable option for the disposition of land disposal restricted waste; however, disposal is acceptable if treatment options are used to bring the waste into compliance.

Decommissioned submarine reactor components are currently being emplaced at the Hanford Site under an interim agreement with the U.S. Navy and the DOE. These components contain a large amount of elemental lead used for shielding and small quantities of PCB impregnated felt. A compliance agreement has been negotiated with the EPA regarding the use of a trench for this PCB material pursuant to TSCA. Elemental lead is considered EHW by the State (Trueblood 1988). As such, the Navy has agreed to conduct a study to determine the BDAT to safely contain or otherwise dispose of the lead content in the reactor cores.

5.4.1 Disposal of Land Disposal Restricted-Radioactive Mixed Waste in a Resource Conservation and Recovery Act-lined Leachate Collection System

Project W-025, "Non Drag-Off Trench," is a RCRA-compliant liner leachate trench design employing a leachate collection system. Treated RMW, meeting the requirements of RCW 70.105, is planned for final disposal in this trench. The trench is planned for construction in the 200 West Area and will be operational in FY 1992. A conceptual layout of the trench is shown in Figure 5-4.

Figure 5-4. Radioactive Mixed Waste Resource Conservation and Recovery Act-Compliant Disposal Facility.



This page intentionally left blank.

6.0 FUTURE WASTESTREAMS AND DISPOSAL ALTERNATIVES

Since the need to treat the volume of waste at the Hanford Site and other Federal facilities is such a pressing issue, new technologies are being developed to deal with the need for treatment. These new technologies will be communicated through existing technology exchange programs and through new standards of treatment promulgated by the EPA, Ecology, and DOE. As these new technologies are made available, the Hanford Site will look at possible applications to the volume of RMW currently stored onsite and applications to future wastestreams. Although new technology will be pursued, minimization and reduction of existing wastestreams will continue to be the most cost-effective option and will be pursued as a primary solution.

6.1 TREATMENT, STORAGE, AND DISPOSAL TECHNOLOGIES

The WRAP facility and hexone incineration are all in developmental stages; while it is probable that these facilities or treatment options will meet prescribed LDR treatment standards, it cannot be completely assured. The only option currently available,other than minimization and recycling, is the storage of RMW in the HCWC and various interim storage areas at the Hanford Site.

The emerging technology of treatment of uranium-contaminated PCB could provide a way to reduce the radioactive constituents to a level that would yield a product no longer considered RMW. This would allow the incineration of the PCB wastes at a commercial incinerator, thus reducing the cost of storage and treatment.

This page intentionally left blank.

7.0 REFERENCES

DOE, 1988a, "Hazardous and Radioactive Mixed Waste Program," DOE 5400.3, U.S. Department of Energy Headquarters, Washington D.C. (1988).

DOE, 1988b, "Radioactive Waste Management," DOE Order 5820.2A, U.S. Department of Energy Headquarters, Washington D.C. (1988).

DOE, 1988c, "Dangerous Waste Permit Application, PUREX Tunnels 1 and 2," DOE/RL-88-21, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, (December 1988).

DOE, 1989a, "Rocky Flats Plant Federal Facilities Compliance Agreement," U.S. Department of Energy-Denver Operations Office, Denver, Colorado (1989).

DOE, 1989b, "Hanford Federal Facility Agreement and Consent Order," Washington State Department of Ecology, U.S. Environmental Protection Agency, and the U.S. Department of Energy-Richland Operations Office, Richland, Washington (1989).

DOE, 1989c, "Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant," WIPP-DOE-069, Rev. 3, U.S. Department of Energy, Albuquerque, New Mexico (1989).

Greenhalgh, W. O., 1989, "Westinghouse Hanford Company Waste Minimization Actions for Fiscal Year 1988," WHC-SA-0495-FP, Westinghouse Hanford Company, Richland, Washington (May 1989).

Stickney, R. G., 1989, "Hanford Site Radioactive Solid Waste Acceptance Criteria," WHC-EP-0063-1, Westinghouse Hanford Company, Richland, Washington (September 1989).

Trueblood, C. S., 1989, "Washington State Hazardous Waste Program: Differences Between State and Federal Regulations," Preston, Thorgrimson, Ellis, and Holman, Spokane, Washington (November 28, 1989).

This page intentionally left blank.

APPENDIX

LAND DISPOSAL RESTRICTED WASTES, CONCENTRATION LIMITS, AND TREATMENT OPTIONS

This page intentionally left blank.

APPENDIX
LAND DISPOSAL RESTRICTED WASTES, CONCENTRATION LIMITS, AND TREATMENT OPTIONS

The following tables list Federal and State land disposal restricted wastes as well as concentration limits and approved treatment options, if available. California listed wastes are also included. The tables are restricted to potential hazardous wastes components that could be found at the Hanford Site. The reader is directed to the Code of Federal Regulations (CFR) Title 40 Part 268 and Washington Administrative Code (WAC) 173-303-140 for a comprehensive list of land disposal restricted wastes.

Table 1. Schedule for Evaluation of Federally Land Disposal Restricted Waste.

Waste Category	Restriction Date
Listed solvents and dioxins	November 8, 1986
California list wastes	July 8, 1987
First third listed wastes (except RMW first third)	August 8, 1988
CERCLA/RCRA soil and debris	November 8, 1988
Second third listed wastes	June 8, 1989
Third third listed wastes, characteristic waste, and RMW thirds	May 8, 1990

Table 2. Federally Land Disposal Restricted Solvents and Dioxins Potentially Generated at Hanford. (sheet 1 of 2)

Spent Solvents	Concentration in Extract (in mg/l)*	
	Wastewater	Other Solvent Waste
Acetone	0.05	0.59
Benzene	NO TREATMENT STANDARD	
n-Butyl alcohol	5.0	5.0
Carbon disulfide	1.05	4.81
Carbon tetrachloride	0.05	0.96
Chlorobenzene	0.15	0.05
Cresols (and cresylic acid)	2.82	0.75
Cyclohexanone	0.125	0.75
1,2-Dichlorobenzene	0.65	0.125
2-Ethoxyethanol	NO TREATMENT STANDARD	
Ethyl acetate	0.05	0.75
Ethylbenzene	0.05	0.053
Ethyl ether	0.05	0.75
Isobutanol	5.0	5.0
Methanol	0.25	0.75
Methylene chloride	0.20	0.96
Methyl ethyl ketone	12.7	0.96
Methyl isobutyl ketone	0.05	0.33
Nitrobenzene	0.66	0.125
2-Nitropropane	NO TREATMENT STANDARD	
Pyridine	1.12	0.33
Tetrachloroethylene	0.079	0.05
Toluene	1.12	0.33
1,1,1-Trichloroethane	1.05	0.41
1,1,2-Trichloroethane	NO TREATMENT STANDARD	
1,2,2-Trichloro-1,2,2-Trifluoroethane	1.05	0.96
Trichloroethylene	0.062	0.091
Trichlorofluoromethane	0.05	0.96
Xylene	0.05	0.15

Table 2. Federally Land Disposal Restricted Solvents and Dioxins Potentially Generated at Hanford. (sheet 2 of 2)

Dioxins	Concentration*
All Hexachlorodibenzo-p-dioxins	< 1 ppb
All Hexachlorodibenzofurans	< 1 ppb
All Pentachlorodibenzofurans	< 1 ppb
All Tetrachlorodibenzo-p-dioxins	< 1 ppb
All Tetrachlorodibenzofurans	< 1 ppb
2,4,5-Trichlorophenol	< 0.05 ppm
2,4,6-Trichlorophenol	< 0.05 ppm
2,3,4,6-Tetrachlorophenol	< 0.10 ppm
Pentachlorophenol	< 0.01 ppm

*Concentrations are based on waste extract levels using the Toxic Characteristic Leaching Procedure (Appendix I, 40 CFR 268).

Table 3. Federally Land Disposal Restricted California List Wastes Potentially Generated at Hanford.

California List Waste Standard	Treatment
Liquid waste pH < 2	pH > 2 and Solidification
Liquid hazardous waste with PCBs[b] ≥ 50 ppm	Incineration (≥ 500ppm) Incin. or Industrial Boiler (50 ppm ≥ PCB ≤ 500 ppm)
Hazardous waste with HOCs[c] ≥ 1,000 mg/kg (mg/l)	Incineration or Boiler (except wastewaters < 1% HOC - must be treated to < 1,000 mg/l)
Liquid hazardous waste containing heavy metals	
Arsenic > 500 mg/l[a]	
Cadmium > 100 mg/l[a]	
Chromium VI > 500 mg/l[a]	
Lead > 500 mg/l[a]	
Mercury > 20 mg/l[a]	
Nickel > 134 mg/l[a]	
Selenium > 100 mg/l[a]	
Thallium > 130 mg/l[a]	
Liquid hazardous waste containing free cyanides > 1,000 mg/l[a]	

[a]Wastes prohibited at statutory prohibition level; no actual treatment standards promulgated to date other than disposal as a non-liquid

[b]Polychlorinated Biphenyls

[c]Halogenated Organic Compounds (see Table 4 for specific compounds).

Table 4. Halogenated Organic Compounds Subject to the California List Restrictions.

Aldrin	1,2-Dibromo-3-chloropropane	Kepone
Aroclor 1016	Dibromomethane	Methoxychlor
Aroclor 1221	1,2-Dibromomethane	Methylene chloride
Aroclor 1232	trans 1,4-Dichloro-2-butene	4,4'-Methylenebis(2-chloroaniline)
Aroclor 1242	m-Dichlorobenzene	PCBs not otherwise specified
Aroclor 1248	o-Dichlorobenzene	Pentachlorobenzene
Aroclor 1254	p-Dichlorobenzene	Pentachlorodibenzo p-dioxins
Aroclor 1260	3,3'-Dichlorobenzidine	Pentachoorodibenzofuran
alpha-BHC	Dichlorodifluoromethane	Pentachloroethane
beta-BHC	1,1-Dichloroethane	Pentachloronitrobenzene
gamma-BHC	trans-1,2-Dichloroethene	Pronamide
Bis(2-chloroethoxy)ethane	1,1-Dichloroethylene	Silvex
Bis(2-chloroethyl)ether	2,4-Dichlorophenol	2,4,5-T
Bis(2-chloroisopropyl)ether	2,6-Dichlorophenol	1,2,4,5-Tetrachlorobenzene
Bromodichloromethane	2,4-Dichlorophenoxyacetic acid	2,3,4,8-Tetrachlorodibenzo-p-dioxin
Bromomethane	1,2-Dichloropropane	Tetrachlorodibenzo-pdioxins
Carbon tetrachloride	cis-1,3-Dichloropropene	Tetrachlorodibenzo-p-dioxins
Chlordane	trans 1,3-Dichloropropene	1,1,1,2-Tetrachloroethane
2-Chloro 1,3-butadiene	Dieldrin	1,1,2,2-Tetrachloroethane
p-Chloro-m-cresol	Endosulfan I	Tetrachloroethene
p-Chloroaniline	Endosulfan II	2,3,4,6-Tetrachlorophenol
Chlorobenzene	Endrin	Toxaphene
Chlorobenzilate	Endrin aldehyde	Tribromomethane
Chlorodibromomethane	Heptachlor	1.2.4-Trichlorobenzene
Chloroethane	Heptachlor epoxide	1.1.1-Trichloroethane
2-Chloroethyl vinyl ether	Hexachlorobenzene	1.1.2-Trichloroethane
Chloroform	Hexachlorobutadiene	Trichloroethene
Chloromethane	Hexachlorocyclopentadiene	Trichloromonofluoromethane
2-Chloronaphthalene	Hexachlorodibenzo-p-dioxins	2,4,5-Trichlorophenol
2-Chlorophenol	Hexachlorodibenzofuran	2,4,6-Trichlorophenol
3-Chloropropene	Hexachloroethane	1,2,3-Trichloropropane
3-Chloropropionitrile	Hexachloropropene	Tris(2,3-dibromopropyl)phosphate
DDD	Hexachloroprophene	Vinyl chloride
DDE	Iodomethane	
DDT	Isodrin	

Table 5. Federally Land Disposal Restricted "First Third" Wastes Potentially Generated at Hanford. (sheet 1 of 2)

		Wastewaters (mg/l)	Nonwastewaters (mg/kg)
Listed Waste (from 40 cfr 261.33([e]) - Treatment Standard Promulgated[a]			
P030	Cyanide salts		
	Cyanides - total	1.9	110
	Cyanides - amenable	0.10	9.1
P039	Disulfoton	0.025	0.1
P041	Diethyl-p-nitrophenyl phosphate	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE
P063	Hydrogen cyanide		
	Cyanides - total	1.9	110
	Cyanides - amenable	0.10	9.1
P071	Methyl parathion	0.025	0.1
P089	Parathion	0.025	0.1
P094	Phorate	0.025	0.1
P097	Famphur	0.025	0.1

Listed Waste (From 40 CFR 261.33([e]) - Soft Hammer Wastes[b]

P001	Warfarin (>.3%)	P004	Aldrin
P005	Allyl alcohol	P010	Arsenic acid
P011	Arsenic (V) oxide	P012	Arsenic (III) oxide
P015	Beryllium dust	P016	Bis-(chloromethyl) ether
P018	Brucine	P020	Dinoseb
P036	Dichlorophenylarsine	P037	Dieldrin
P048	2,4-Dinitrophenol	P050	Endosulfan
P058	Fluoroacetic acid, Na salt	P059	Heptachlor
P069	Methyllactonitrile	P068	Methyl Hydrazine
P090	Aldicarb	P081	Nitroglycerine
P084	N-Nitrosodimethylamine	P084	N-Nitrosomethylvinylamine
P087	Osmium tetraoxide	P092	Phenylmercuric acetate
P102	Propargyl alcohol	P105	Sodium azide
P108	Strychnine and salts	P110	Tetraethyl lead
P115	Thallium (i) sulfate	P120	Vanadium pentoxide
P122	Zinc phosphide (>10%)	P123	Toxaphene

Table 5. Federally Land Disposal Restricted "First Third" Wastes Potentially Generated at Hanford. (sheet 2 of 2)

Listed Waste (From 40 CFR 261.33[f]) - Treatment Standard Promulgated[a]			
		Wastewaters	Nonwastewaters
U221	Toluenediamine	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE
U223	Toluene diisocyanate	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE

Listed Waste (From 40 CFR 261.33[f]) - Soft Hammer Wastes[b]			
U007	Acrylamide	U009	Acrylonitrile
U010	Mitomycin C	U012	Aniline
U016	Benz(c)acridine	U018	Benz(a)anthracene
U019	Benzene	U022	Benzo(a)pyrene
U029	Methyl bromine	U031	N-Butanol
U036	Chlordane, technical	U037	Chlorobenzene
U041	n-Chloro-2,3-epoxypropane	U043	Vinyl chloride
U044	Chloroform	U046	Chloromethyl methyl ether
U050	Chrysene	U051	Creosote
U053	Crotonaldehyde	U061	DDT
U063	Dibenz o (a, h) anthracene	U064	1,2:7,8 Dibenzopyrene
U066	Dibromo-3-chloropropane 1,2-	U067	Ethylene dibromide
U074	1,4-Dichloro-2-dibutene	U078	Dichloroethylene, 1,1-
U086	N,N Diethylhydrazine	U089	Diethylstilbestrol
U103	Dimethyl sulfate	U105	2,4-Dinitrotoluene
U108	Dioxane, 1,4-	U115	Ethylene oxide
U122	Formaldehyde	U124	Furan
U129	Lindane	U130	Hexachlorocyclopentadiene
U133	Hydrazine	U134	Hydrofluoric acid
U137	Indeno (1,2,3-cd) pyrene	U151	Mercury
U154	Methanol	U155	Methapyrilene
U157	3-Methylcholanthrene	U158	4,4-Methylene-bis-(2-chloroaniline)
U159	Methyl ethyl ketone	U171	Nitropropane, 2-
U177	N-Nitroso-N-methylurea	U180	N-Nitrosopyrrolidine
U185	Pentachloronitrobenzene	U188	Phenol
U192	Pronamide	U200	Resurpine
U209	Tetrachloroethane, 1,1,2,2-	U210	Tetrachloroethylene
U211	Carbon tetrachloride	U219	Thiourea
U220	Toluene	U226	Methylchloroform
U227	Trichloroethane, 1,1,2-	U228	Trichloroethylene
U237	Uracil mustard	U238	Ethyl carbamate
U248	Warfarin (<.3%)	U249	Zinc phosphide (<10%)

[a]Land disposal prohibited above specified concentration.
[b]No treatment standards for these wastes have been promulgated to date.

Table 6. Federally Land Disposal Restricted "Second Third" Wastes Potentially Generated at Hanford. (sheet 1 of 3)

Listed Waste (From 40 CFR 261.33([e]) - Treatment Standard Promulgated[a]		Wastewaters (mg/l)	Nonwastewaters (mg/kg)
P029	Copper Cyanides		
	Cyanides - total	110	1.9
	Cyanides - amenable	9.1	0.10
P040	O,O-Diethyl o-pyrazinyl phosphorothioate	INCINERATION OR INCINERATION	CARBON ADSORPTION OR INDUSTRIAL BOILER/FURNACE
P043	Diisopropyl fluorophosphate	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE
P044	Dimethoate	INCINERATION OR INDUSTRIAL BOILER/FURNACE	CARBON ADSORPTION OR INCINERATION
P062	Hexaethyltetraphosphate	INCINERATION OR INCINERATION	CARBON ADSORPTION OR INDUSTRIAL BOILER/FURNACE
P074	Nickel cyanide		
	Cyanides - total	110	1.9
	Cyanides - amenable	9.1	0.10
	Nickel	0.44	0.32(mg/l in extract)
P085	Octamethyl pyrophosphoramide	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE
P098	Potassium cyanide		
	Cyanides - total	110	1.9
	Cyanides - amenable	9.1	0.10

Table 6. Federally Land Disposal Restricted "Second Third" Wastes Potentially Generated at Hanford. (sheet 2 of 3)

		Wastewaters (mg/l)	Nonwastewaters (mg/kg)
Listed Waste (From 40 CFR 261.33([e]) - Treatment Standard Promulgated[a]			
P104	Silver cyanide		
	Cyanides - total	110	1.9
	Cyanides - amenable	9.1	0.10
	Silver		0.072(mg/l in extract)
P106	Sodium cyanide		
	Cyanides - total	110	1.9
	Cyanides - amenable	9.1	0.10
P111	Tetraethylpyrophosphate	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE

Listed Waste (From 40 CFR 261.33([e]) - Soft Hammer Wastes[b]			
P002	1-Acetyl-2-thiourea	P003	Acrolein
P007	5-(Aminoethyl)-3-isoxazolol	P008	4-Aminopyridine
P014	Thiophenol	P026	1-(o-Chlorophenyl)thiourea
P027	Propanenitrile, 3-chloro	P049	2,4-Dithiobiuret
P054	Aziridine	P057	Fluoracetamide
P060	Isodrin	P066	Methomyl
P067	2-Methylaziridine	P072	Alpha-napthylthiourea
P085	Octamethylpyrophosphoramide	P107	Strontium sulfide
P112	Tetranitromethane	P113	Thallic oxide
P114	Thallium (I) selenite		

		Wastewaters (mg/l)	Nonwastewaters (mg/kg)
Listed Waste (From 40 CFR 261.33[f]) - Treatment Standard Promulgated[a]			
U028	Bis-(2-ethylhexyl)phthalate	28	0.54
U058	Cyclophosphamide	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE
U107	Di-n-octyl phthalate	28	0.54
U235	tris-(2,3-Dibromopropyl) phosphate	0.025	0.1

Table 6. Federally Land Disposal Restricted "Second Third" Wastes Potentially Generated at Hanford. (sheet 3 of 3)

Listed Waste (From 40 CFR 261.33[f]) - Soft Hammer Wastes[b]			
U002	Acetone	U003	Acetonitrile
U005	o-Acetylaminofluorene	U008	Acrylic acid
U011	Amitrole	U014	Auramine
U015	Azaserine	U020	Benzenesulfonyl chloride
U021	Benzidine	U023	Benzotrichloride
U025	Dichloroethyl ether	U026	Chlornaphazine
U032	Calcium chromate	U035	Chlorambucil
U047	Beta-chloronaphthalene	U049	4-Chloro-o-toluidine, hydrochloride
U057	Cyclohexanone	U059	Daunomycin
U060	DDD	U062	Diallate
U070	o-Dichlorobenzene	U073	Dichlorobenzidene, 3,3-
U080	Methylene chloride	U083	Dichloropropane, 1,2-
U092	Dimethylamine	U093	Dimethylaminoazobenzene
U094	Dimethylbenz(a)anthracene, 7,12-	U095	Dimethylbenzidine, 3,3'-
U097	Dimethylcarbamoyl chloride	U098	Dimethylhydrazine, 1,1-
U099	Dimethylhydrazine, 1,2-	U104	Dimethylphenol, 2,4-
U106	Dinitrotoluene, 2,6-	U110	Dipropylamine
U109	1,2-Diphenylhydrazine	U111	Di-N-Propylnitrosamine
U114	Ethylenebis-(dithiocarbamic acid)		
U116	Ethylene thiourea	U119	Ethyl methanesulfonate
U127	Hexachlorobenzene	U128	Hexachlorobutadiene
U131	Hexachloroethane	U135	Hydrogen sulfide
U138	Methyl iodide	U140	Isobutyl alcohol
U142	Kepone	U143	Lasiocarpine
U144	Lead acetate	U146	Lead subacetate
U147	Maleic anhydride	U149	Malonitrile
U150	Melphalan	U161	Methyl isobutyl ketone
U162	Methyl methacrylate	U163	N-Methyl-N-nitro-N-nitrosoguanidine
U164	Methylthiouracil	U165	Napthalene
U168	Napthylamine, 2-	U169	Nitrobenzene
U170	p-Nitrophenol	U172	N-Nitroso-di-n-butylamine
U173	N-Nitroso-diethanolamine	U174	N-Nitroso-diethylamine
U176	N-Nitroso-N-ethylurea	U178	N-Nitroso-N-methylurethane
U179	N-Nitrosopiperidine	U189	Phosphorus sulfide
U193	1,3-Propane sultone	U196	Pyridine
U203	Safrole	U205	Selenium disulfide
U206	Streptozotocin	U208	Tetrachloroethane, 1,1,1,2-
U213	Tetrahydrofuran	U214	Thallium (I) acetate
U214	Thallium (I) carbonate	U216	Thallium (I) chloride
U217	Thallium (I) nitrate	U218	Thioacetamide
U239	Xylene	U244	Thiram

[a]Land disposal prohibited above specified concentration.
[b]No treatment standards for these wastes have been promulgated to date.

Table 7. Federally Land Disposal Restricted "Third Third" Wastes Potentially Generated at Hanford. (sheet 1 of 3)

Listed Waste (From 40 CFR 261.33[e]) - Treatment Standards Promulgated[a]			
		Wastewaters (mg/l)	Nonwastewaters (mg/kg)
P013	Barium cyanide		
	Cyanides - total	1.9	110
	Cyanides - amenable	0.10	9.1
P021	Calcium cyanide		
	Cyanides - total	1.9	110
	Cyanides - amenable	0.10	9.1
P099	Potassium silver cyanide		
	Cyanides - total	1.9	110
	Cyanides - amenable	0.10	9.1
	Silver	0.072(mg/l in extract)	
P109	Tetraethyldithiopyrophosphate	CARBON ADSORPTION OR INCINERATION	INCINERATION OR INDUSTRIAL BOILER/FURNACE
P121	Zinc cyanide		
	Cyanides - total	1.9	110
	Cyanides - amenable	0.10	9.1

Listed Waste (From 40 CFR 261.33([e]) - not restricted until MAY 8, 1990[b]			
P006	Aluminum phosphide	P009	Ammonium picrate
P017	Bromoacetone	P022	Carbon disulfide
P023	Chloroacetaldehyde	P024	p-Chloroaniline
P028	Benzyl chloride	P031	Cyanogen
P033	Cyanogen chloride	P034	4,6-Dinitro-o-cyclohexylphenol
P038	Diethylarsine	P042	Epinephrine
P045	Thiofanox	P046	Alpha, alpha-Dimethylphenethylamine
P047	4,6-Dinitro-o-cresol & salts	P051	Endrin
P056	Fluorine	P064	Methyl isocyanate
P065	Mercury fulminate	P073	Nickel carbonyl
P075	Nicotine and salts	P076	Nitric oxide
P077	p-Nitroaniline	P078	Nitrogen dioxide
P088	Endothall	P093	N-Phenylthiourea
P095	Phosgene	P096	Phosphine
P101	Propanenitrile	P103	Selenourea
P116	Thiosemicarbazide	P118	Trichloromethanethiol
P119	Ammonium vanadate		

Table 7. Federally Land Disposal Restricted "Third Third" Wastes Potentially Generated at Hanford. (sheet 2 of 3)

Listed Waste (From 40 CFR 261.33[e]) - Treatment Standards Promulgated[a]			
		Wastewaters (mg/l)	Nonwastewaters (mg/kg)
Listed Waste (From 40 CFR 261.33[f]) - Treatment Standard Promulgated[a]			
		Wastewaters (mg/l)	Nonwastewaters (mg/kg)
U069	Dibutyl phthalate	0.54	28
U087	0,0,-Diethyl-S-methyl-dithiophosphate	0.54	28
U088	Diethyl phthalte	0.54	28
U102	Dimethyl phthalate	0.54	28
U190	Phthalic anhydride (measured as phthalic acid)	0.54	28

Listed Waste (From 40 CFR 261.33[f]) - not restricted until May 8, 1990[b]			
U001	Acetaldehyde	U004	Acetophenone
U006	Acetyl chloride	U017	Benzal chloride
U024	Bis(2-chloroethyoxy) methane	U027	Bis(2-chloroisopropyl) ether
U030	Benzene, 1,bromo-4-phenoxy	U033	Carbonyl fluoride
U034	Chloral	U038	Ethyl-4-4'-dichlorobenzilate
U039	4-Chloro-m-cresol	U042	Vinyl ether, 2-chloroethyl
U045	Methyl chloride	U048	o-Chlorophenol
U052	Cresols	U055	Cumene
U056	Cyclohexane	U068	Methane, dibromo
U071	m-Dichlorobenzene	U072	p-Dichlorobenzene
U075	Dichlorodifluoromethane	U076	Ethane, 1,1-dichloro-
U079	1,2-Dichloroethylene	U081	2,4-Dichlorophenol
U082	2,6-Dichlorophenol	U084	1,3-Dichloropropene
U085	2,2'-Bioxirane	U090	Dihydrosafrole
U091	3,3'-Dimethoxybenzidine	U096	alpha,alpha-Dimethyl-benzylydroxyperoxide
U112	Ethyl acetate		
U113	Ethyl acrylate	U117	Ethyl ether
U118	Ethylmethacrylate	U120	Fluoroanthene
U121	Trichloromonofuuoromethane	U123	Formic acid
U125	Furfural	U126	Glycidylaldehyde
U132	Hexachlorophene	U136	Cacodylic acid
U139	Iron dextran	U141	Isosafrole
U145	Lead phosphate	U148	Maleic hydrazide
U152	Methacrylonitrile	U153	Methanethiol
U156	Methyl chlorocarbonate	160	Methyl ethyl ketone peroxide
U166	1,4-Napthaquinone	U167	1-Napthylamine

Table 7. Federally Land Disposal Restricted "Third Third" Wastes Potentially Generated at Hanford. (sheet 3 of 3)

Listed Waste (from 40 CFR 261.33[f]) - Not Restricted Until May 8, 1990[b]			
U181	5-Nitro-o-toluidine	U182	Paraldehyde
U183	Pentachlorobenzene	U184	Pentachloroethane
U186	1,3-Pentadiene	U187	Phenacetin
U191	2-Picoline	U194	1-Propanamine
U197	p-Benzoquinone	U201	Resorcinol
U202	Saccharin and salts	U204	Selenious acid
U207	1,2,4,5-Tetrachlorobenzene	U222	o-Toluidine hydrochloride
U225	Bromoform	U234	Sym-Trinitrobenzene
U236	Trypan blue	U240	2,4-D, salts and esters
U243	Hexachloropropene	U246	Cyanogen bromide
U247	Methoxychlor		

Characteristic Waste - not restricted until May 8, 1990[b]	
Ignitable	(Flash Point $\leq$ 140 degrees Fahrenheit)
Corrosive	($2.0 \geq$ pH ≥ 12.5)
Reactive	(explosive, water reactive, toxic gas generator, free cyanide or sulfide-bearing, etc.)

Extraction Procedure Toxic

Contaminant	Concentration in Extract (in mg/l)[c]
Arsenic	$\geq$ 5.0
Barium	$\geq$ 100.0
Cadmium	$\geq$ 1.0
Chromium	$\geq$ 5.0
Lead	$\geq$ 5.0
Mercury	$\geq$ 0.2
Selenium	$\geq$ 1.0
Silver	$\geq$ 5.0
Endrin	$\geq$ 0.02
Lindane	$\geq$ 0.4
Methoxychlor	$>$ 10.0
Toxaphene	$\geq$ 0.5
2,4-D	$\geq$ 10.0
2,4,5-TP	$\geq$ 1.0

[a]Wastes currently restricted from land disposal
[b]Wastes not restricted until May 8, 1990
[c]Concentrations are based on extracts using the Extraction Procedure Toxicity Test (40 CFR 261 Appendix II).

Table 8. State-only Land Disposal Restricted Wastes Potentially Generated at Hanford.

State Restricted Waste	
Standard	Treatment
Liquid dangerous waste	Solidification
Ignitable and reactive waste	Treatment to non-ignitable or non-reactive designation
Extremely hazardous waste (Nonradioactive)	Treatment to non-EHW designation
Extremely hazardous waste (Radioactive)	Use of all reasonable methods of treatment, detoxification, neutralization, etc., to mitigate hazards associated with waste
Solid acid waste	Treatment to non-acidic designation
Organic/carbonaceous waste	Incineration
Leachable inorganic waste	Solidification

DISTRIBUTION

Number of Copies

ONSITE

12 U.S. Department of Energy-
Richland Operations Office

G. J. Bracken (5)	A6-80
P. K. Clark	A6-80
R. F. Guercia (2)	A6-80
R. D. Izatt	A6-80
M. W. Shupe	A6-80
Reading Room (2)	A1-65

54 Westinghouse Hanford Operations

B. C. Anderson	R2-87
J. D. Anderson	R2-82
J. W. Badden	B2-19
H. C. Boynton	R2-82
P. A. Craig	R1-51
J. A. Demiter	R2-87
G. T. Dukelow	R2-97
D. R. Duncan	R2-87
J. P. Estrellado	R2-05
L. A. Fort	R2-87
W. P. Gilles	R2-87
P. H. Jacobsen	R2-87
W. G. Jasen	R2-82
R. S. Kelley	R2-87
D. W. Lindsey	R2-82
R. S. McBeath	R2-87
D. C. McCann	R2-82
M. M. McCarthy	N1-34
D. E. McKenney	R2-11
S. H. Norton	T3-28
B. E. Opitz	R1-19
D. E. Plowman	R2-87
B. E. Poremba	R2-82
L. L. Powers	B2-19
R. W. Reddinger	R2-87
C. C. Ripley	R2-87
R. J. Roberts	R2-97
J. L. Scott	R2-87
R. G. Stickney	R2-82

DISTRIBUTION (continued)

Number of Copies

ONSITE

J. L. Waite	B2-35
G. A. Whitney	R2-87
D. W. Wilson	R1-51
D. D. Wodrich	R2-23
J. C. Womack	R2-18
M. A. Wood	R2-87
J. J. Zimmer	R2-05
EDMC (6)	H4-22
Publications Services (11)	R1-08
Central files (2)	L8-15